Total Factor Productivity of Agriculture Sector and Economic Growth of Pakistan

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NATIONAL UNIVERSITY OF MODERN LANGUAGES

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With the Name of Allah, the Merciful,

the most Compassionate

Dedication

I want to dedicate my thesis to my parents Wali Khan and Nagina Naz, brothers, Sardar Daud, Shah Saud and sisters Umi e Aiman and Kashmala, Uncle Tariq Kamal and Abbas Ali Shah and to my friends with whom none of my success would be possible.

Acknowledgements

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LIST OF ACRONOYMS

ADF	Augmented Dickey-Fuller
AFP	Aggregate Production Function
AI	Arithmetic Index
APCOM	Agriculture Prices Commission
ARDL	Autoregressive Distributed Lag
ECM	Error Correction Mechanism
ECT	Error Correction Term
CS	Capital Stock Formation
GDP	Gross Domestic Product
GOP	Government of Pakistan
IFPRI	International Food Policy Research Institute
OLS	Ordinary Least Square
PBS	Pakistan Bureau of Statistics
R & D	Research and Development
TFP	Total Factor Productivity
TFP	Total Factor Productivity
T-T	Tornqvist-Theil
ARE	Agricultural Research and Extension
PFF	Partial Factor Productivity
ASP	Agriculture Statistic of Pakistan

ABSTRACT

The current research describes the Total Factor Productivity (TPF)of agriculture sector and GDP growth of Pakistan, by utilizing Autoregressive *Distributed Lag model from 1980-2018. while constructing of the production function, we were utilized most of the common variables in the production function. In the constructing of productivity and input quantity index, the data of input and output were utilized respectively. The data of GDP, capital used in agriculture, and labor used in agriculture to obtain the agriculture TFP of Pakistan. The time series data from 1980-2018 was taken from various publications or official resources. For this study period the estimated annual average agriculture TFP growth was 2.14 percent and it contribute 58 percent to the overall agriculture output. The findings explain that the TFP of agriculture sector was highest 2.86 from few years and smallest 0.96 in 70s. In 80s as well as in 90s the growing rate of agriculture TFP was 2.24 and 2.46 percent. During the decade of 1970s,1980s,1990s, the TFP growth contributed around 33,53,81 and 81 percent to the agriculture productivity growth. The analysis of TFP of agriculture sector shows a variation in the TFP growth, it is due to the bad weather conditions, public interference and macroeconomics strategies.*

The important goal of the research is to define the TFP of agriculture sector, and GDP growth of the country. A country like Pakistan, there is a difficulty to get the data of TFP of agriculture sector, it is not available in any approved document. So, the first intention of the research is to obtain the data of TFP of agriculture sector. First, we find out the agricultural sector TFP and then to find the GDP growth of the country, utilizing TFP being as an independent variable while calculating the GDP growth. Augment Dickey Fuller approach is employed to examine, the existence of unit root with variables. If the variables are not at stationary and not at level, then it will made at level by the 1st difference. The economic growth of the country is showing a positive as per the coefficient of the variables, as well as it is substantial in long and short run. Capital stock and labor show a positive impression on the TFP development of the agriculture region. Capital, labor, arable land, agriculture growth shows a clear and substantial impact on the GDP growth of Pakistan. As well as capital, labor and arable land gets a positive impact on the agriculture development, and that is a positive sign for the economic growth of the country. So the findings shows that there is a need to increase capital stock, skill labor, and cultivated land to increase the agriculture growth, and these are the key factors for the betterment of the agricultural TFP of Pakistan.

INTRODUCTTION_____

In Pakistan, after the industrial sector agriculture region is second prominent sector for the economic progress of Pakistan. there is a large number of people in the country who depends upon on the agriculture sector. It is the main foundation for living and development. It contributes 18.5 percent to the total GDP, and it is also the most important source of employment (38.5 percent to the total labor force) for the people of the country. But it persists the backward sector of the economy. It's also contributed to an economic growth, when the industrial sector gets the raw material from this sector, so in that's way it can increase the foreign exchange earnings of the country. The foreign exchange earnings will increase because of market for the industrial goods. The decrease in the agriculture division productivity is the key problem towards the GDP growth and it cause the decrease in the GDP growth of the country. In spite in 2010-11 the modest growth is recorded 1.2 percent in the agriculture sector, there is much need to support this sector to increase export, revival of the industrials sector is responsible to encouraging the consumption. In 2018 to 2019 the agriculture growth is very low as compare to the target set by the government. The cumulative growth rate is only 0.85 percent is very much less than the target 3.8 set at the beginning of the year. But it still provides a positive support to the manufacturing sector to increase exports. So, whatever happens the agriculture sector is not the only factor to increase or decrease the GDP growth of the country, there is a few more sectors, by which there is increase in the GDP growth of the country (Economic survey of Pakistan 2018-19).

1.1 Agriculture Growth and Economy of Pakistan

The agriculture growth in 2018-19 was remained subdued. In the beginning of the year target was 3.8 percent but the growth was 0.85 percent, which is very much lower as compare to the expected goal. The agriculture average growth rate is around 3.46 percent yearly from the last few periods, In agriculture sector the sustainable growth can be achieved by the use of technological advancement, introduce high yielding seeds, make investment to update the irrigation system, there is need of research and the efficient physical infrastructure. Agriculture sector has become an important sector, and its share is in the total economic growth of 5.03 percent annually. Despite to

this performance, Pakistan imports large amounts of food items as wheat, rice, edible oils and pulses.

In the last decade, the agriculture sector shows a mixed trend. In the 1st decade the first two years of 21st century there is lack of water due to low rain fall, which resulted the reduction in the agriculture output.

In the next year 2002-03 and the next year 2004-05 there is sufficient accessibility of irrigated water, which result a positive effect on the agriculture growth. Which influence the overall agriculture growth was increase as well as the sector showed a strong recovery. In 2005-06 the performance of agriculture sector remains weak because the crop sector, the production of the major crops is not up to the expectation. In 2006-07 growth was increased by 5 percent, the growth was increase by 1.6 percent as compare to the previous year growth. During 2007-08 and 2009-2010 the growth rate shows a mixed trend increasing form o.6 to 4 percent (GOP, 2011). Agriculture sector is the major region for the GDP growth of the country. The agriculture growth contributes positively to the whole market. Overall production of agriculture sector is increasing but not with the sustainable rate or if this growing rate is comparing with agriculture growth of developed countries. For example, if the agriculture growth increased then in the next year it was decreases or increase with the decreasing rate. Table 1.1 shows the overall performance of agriculture sector, then we see that there is a lack of consistency.
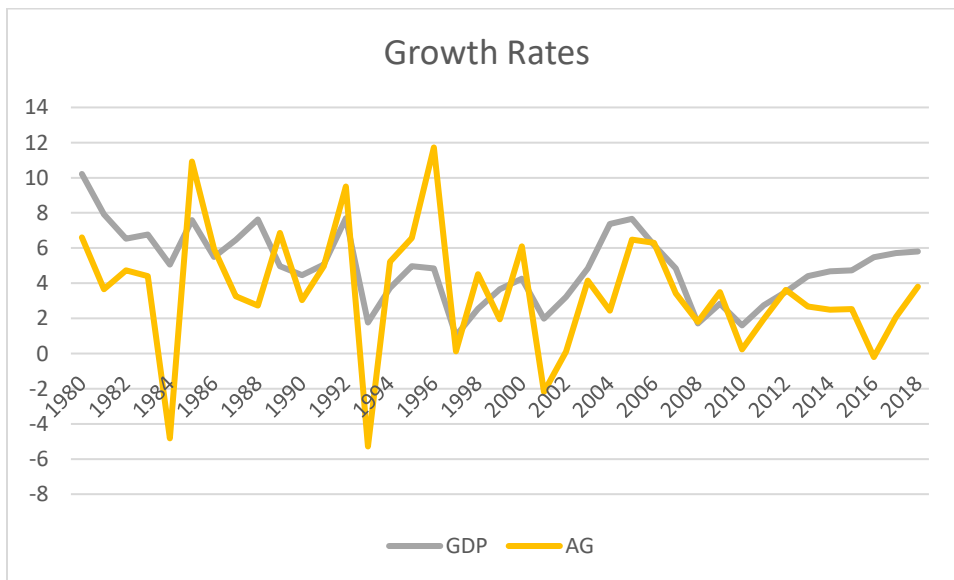
Figure 1.1: Trends in the GDP and Agriculture Growth

In Pakistan the agriculture is considered as an engine of the national GDP growth and main force for the development of the country there is need of sustainable growth in that sector. But in Pakistan, there is an inconsistency in the agriculture growth, in 1954-55 the growing rate of farming sector is 15 percent and in 1952-53 the growth rate is 9 percent. The variation in the growth rate show a bad effect on the whole economy.

In general if we see the difference in the Pakistan economy from the last few periods, in 1950 the share of farming region is 53 percent in the GDP growth of the country, but in 2018 its contributes only 18.5 percent, and in 2010 it was 21.5 percent. It was reduced consistently. In 1950s and in green revolution more than a half of the GDP growth of Pakistan was depend upon on the agriculture sector. By 2018 there is a drop of 32 percent in the contribution of farming sector. With the time being the agriculture sector shows a consistent decrease in the share. So, it causes that the GDP was growing with the low rate. This sector is still the main and the second leading sector for the Pakistan economy (Economic Survey of Pakistan 2018).

1.2 Structure of Agriculture Sector

Agriculture sector is consisting on many sectors like livestock, crop, forestry and fisheries. But the most important agriculture sector is crop sector (wheat, cotton, rice, sugarcane, maize and gram) and the minor crops of the agriculture sector are potatoes, pulses, onion and condiments etc. The productivity of agriculture sector has declined overtime as well as the contribution of the crops is also declining, in 1990-91 the share of crops was 65 percent, but the share was decline to 41 percent in 2010-11. In 2012-13 the growing rate of the important crops in agriculture is 0.17 percent and in 2018-19 it was decline to -6.55 percent. But there is an increase in the contribution of livestock, from 3.45 percent in 2012-13 to 4 percent in 2018-19. Livestock plays a vital role in the life of formers as well as in the farming region of Pakistan. Its support to overcome the shortage of food, increase the income level of the people which is connected with this sector and provide increase employment opportunities for the people of rural sector. It's also contributed in the development of the rural sector. The population growth and the living standard has increased day by day so in a result the demand of livestock products has increasing. But the livestock sector not yet achieved to the enough meat, like beef, mutton and milk as per the requirement of the population. Pakistan is still spending a large amount on the livestock goods, particularly on meat and milk. In the result our foreign exchange earning was declined. The fact is that in Pakistan, the production of livestock

sector is very low, if we compare this to the production of livestock in the developed countries (Abrar, et al., 2002). If we want to decrease the import of livestock products there is a need to increase the production of livestock products like meat and milk.

There is growth of 3.7 percent in the livestock sector during 2010-11. And contributed to the GDP at the rate of 11.5 percent, this contribution is more than the contribution of the entire sub crop sector. So, the livestock sector is particularly valuable sector for the development of rural sector, it will increase the economic growth of the country (GOP,2011). So, to find out the agriculture productivity growth of Pakistan the main sector has been included.

The agriculture sector registered the share of livestock 60.54 percent and its share to GDP was 11.22 percent in 2.18-19. This is more than the share of the entire sub crop sector. So, for the growth and improvement of the rural sector, this sector is very important (GOP 2018). Crop and livestock sector contribute large share to the agriculture output and to the (GDP) while the contribution of forestry and fishing 0.79 percent is low as compare to livestock and crop sector (GOP 2018).

1.3 Source of Agriculture Growth

The agriculture productivity can be increase by those inputs which is used in the agriculture. Agriculture growth can be increased to increase the arable land, when there is enough available for cultivation then it will give more production. Labor force is also the main input to increase the agriculture productivity when there is efficient and skill labor working in the agriculture sector then the agriculture productivity will increase. Capital is the main input to increase the agriculture productivity, there is need of modern technologies, high yielding crops seed, modern method of cultivation, using modern machinery rather than animals in that sector can increase the agriculture productivity.

Table 1.1 shows that the crop sector shows a decline, in 2018-19 there is a decrease of -4.43 percent related to the require target 3.6 percent, as well as there is also a decrease of -6.55 percent in the important crops. The production of Cotton decline by -12.5 percent and the production of Rice decline by -3.3 percent, while the production of Maize crop shows the increasing trend by 6.9 percent, and the growth of wheat was slightly higher by 0.5 percent. The increase in the production of other crops (pulses and oilseeds) is 1.95 percent. The production of Cotton ginning was decrease

by -12.74 percent because the production of cotton is low. The production of livestock and fishing increased by 4.00 and 6.47 percent.

Table 1.1

Agriculture Growth of Pakistan from 2012 to 2019

Sector	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Agriculture	2.68	2.50	2.13	0.15	2.18	3.94	0.85
Crops	1.53	2.64	0.16	-5.27	1.22	4.66	-4.43
Important Crops	0.17	7.22	-1.62	-5.86	2.60	3.56	-6.55
Other crops	5.58	-5.71	2.51	0.40	-2.51	6.15	1.95
Cotton Ginning	-2.90	-1.33	7.24	-22.12	5.58	8.80	-12.74
Livestock	3.45	2.48	3.99	3.36	2.99	3.62	4.00
Fishing	6.58	1.88	-12.45	14.31	-2.33	2.58	6.47
Fishing	0.65	0.98	5.75	3.25	1.23	1.63	0.79

Note. Agriculture Growth rates of Pakistan

Source: Pakistan Bureau of Statistics

The basics of the agriculture growth is the increase in the output of the agriculture sector (Rosegrant and Evenson, 1993). Production is just the ratio of output to inputs. Two method are used generally to find the growth of productivity. First, Partial Factor Productivity (PFP)is used to find out the output of the single production factor. The indicator uses to compute PFP in the literature is land productivity. And the second is Total Factor Productivity find out the amount rise in the total production it is not counted in the increase in overall inputs.

The important thing is change in rate of the TFP with the time is technological progress. The production function can improve by the increase in the technological capability, learning process of production and engineering management. With the same level of input, produced more output. The change in the TFP rate is assessed as an output growth rate minus the involvement of inputs growth. i.e. the remaining determinant that can measure is (land, labor and capital) are accounted for. TFP can measure anything that can changes the relation between find inputs and find output.

The value of total factor productivity may fluctuate year to year. So, the agriculture productivity growth can be viewed as a crucial situation for the improvement of entire economy.

Agriculture region of the country is confronting a significant problem in 21st century as well as in many other developing countries. The present population of Pakistan is about 197 million and increasing with the rate of 2 percent annually. And it is expected that it would be the third populated country of the world till 2050 (GOP). The rapid rise in the population, increases the demand for food, and it is high among the poor. The forecast of the recent projection is that there is a large imbalance in the basic items like (wheat, meat, edible oils and meat etc.). So, there is a need of sustainable efforts to increase the growth agriculture products, like food items. And if import the essential food items it will impose the big burden on the country foreign exchange earnings.

Growth of cultivated area is shown in Table 1.2

The expansion to cultivated land is very slow and decrease over the time. The agriculture productivity growth plays vital role to fulfill the future problems of food in the country. In Pakistan the expansion of cultivated area is decrease from 0.32 percent in (1966-76 to 0.28 percent in 1986-2006). And the cultivated area increased from 0.32 to 0.5 percent during (1966-85). The cultivated land increase from 0.28 to 0.30 in (2007-18). The increase in the cultivated area is shown in table 1.2.

Table 1.2

Cultivated Area by periods

Periods	Cultivated Area (٪)
Green revaluation	0.32
Input Intensification Period (1975-85)	0.50
Post Green Revolution Period (1986-2006)	0.28
From (2007-2018)	0.30

Note. Growth rate of cultivated area

Source: Data based calculation

After intensification, resource degradation was observed in Pakistan's Punjab due to which overall agricultural productivity decreased (Murgai, 1999).

The table shows that there is little chance to increase the arable land. The fall in the arable land is due to the population growth, people used their land to fulfill his residential and industrial purposes. So, this indicate that more load will be on the agriculture productivity growth to fulfill the future demand. Murgai (1999) examine that in Pakistan when the increase in the resource degradation will happen due to this the overall agriculture productivity will decrease.

A rapid growth in the agriculture productivity enhances the welfare of almost population and it help to get the common macroeconomics goals. So, the major goal for Pakistan is sustainable agriculture growth and the economics policy which can achieve the require productivity growth nor the input growth. Ali (2005) described that increase in the population growth cause the decrease in the arable land, so it overcome the cultivated land. there is a need to increase the supply of food production rather than increase in the inputs.

The growth theory in macroeconomics was the creation of the great depression in 1930s. In the growth theory there is three waves of interest. First wave stayed to the work of Domer (1947 and Harrod in (1948)). Second was is associated with the development of neoclassical model on the Solow growth theory. And the third wave was associated with endogenous growth theory as a reaction to the omissions of neoclassical theory. In the endogenous growth theory, the model consists on the endogenous elements of technological progress and it is the integral part of the economic growth theory.

The concept of econometric studies of U.S data, Solow was the first economist in order to understand source outstanding growth in long run, the country had practiced over the long period. He persuaded himself that the drawback of Harrod-Domer model, is that the TFP was the main source of growth, he continued to develop the neoclassical model of economic growth. He observes the effects of technological growth on the aggregate production function, before the developing of dynamic general equilibrium model.

Finally, some economists believed the residual captured to continual reallocation of production resources towards economic activities in which they possessed a comparative advantage.

Economist faced difficulty to define and formalize the total factor productivity. According to Abramotiz (1989) he pointed out that many economists suggest the residual in the growth output there is different ways in 20th century to measure residual in output growth. Most of the economist

agree with the technological residual combined growth in human capital can achieved by increase investment in schooling, provide job training and health facility etc., some economist suggest that there is need of investment in the research and developmental activities, it can gain the increase the productivity growth. At the end, some economists suppose that to capture residual to continuous reallocation of production resources towards economic activities in which they have a comparative advantage.

Thus, Solow (1957) to simplify the total factor productivity, Solow constructed an aggregate production function. It represents that the total output is the function of labor, capital and neutral technical change. Moreover, the shifting factor of the production function from its origin and generate a new level of aggregate output in the economy was the technical change.

In (1956) Solow point out that the unexpected shock in the technological advancement may cause to arise economy. If in the economy there is neutral productivity changes, so a technological advancement generates the high-level growing rates in capital which cause the increase in output. And if there is a change in the consumption and saving, so that allows greater investment for the further capital accumulation. Finally, the neoclassical model suggests that the growth rate in economy can be affect by the monetary or fiscal policy. The economy requires that a model which determine the optimal level of macroeconomic parameter, such as the utility of both sector like the utility of society and as well as the economic growth are maximized.

Furthermore, all around the world the rise in the numerous empirical studies is due to the formalization of the neoclassical model and the worldwide practical demonstration. In (1995) Islam take to describes the average growing rates of several countries by acting the cross-sectional regression analysis on the economics and political factors. As well as by Mankiw et al., in (1992) made a significant empirical as well as the theoretical contribution to neoclassical growth model. The economy rises due to the technological progress is most important extension of the neoclassical model. In the Solow growth theory, the economist is searching for the accurate source of economic growth which cause the Solow growth theory is improved continuously.

1.4 Rational of the Study

In 21st century agriculture sector of Pakistan faced significant challenges, but these challenges were also faced by many other developing countries. The current population of country is 197

million, and it is rising by 2 percent annually. With that rate in 2050 it will be the third populated country of the world (GOP 2011). To get a sustainable economic growth there is a need of those factor who can achieve the overall national developing goals. The demand for food was increasing with the increase in the population growth. So, it is a necessary to enlarge the agriculture productivity to fulfill the requirement of food of the people of the country.

There is need of a sustainable increase in necessary agriculture products to fulfill the supply and demand in future, mostly the food items. The population growth is increasing continuously, and the supply per capita arable is diminishing over the time, so there is need to expend the cultivated land. When the cultivated land is increase so the production will increase. The developing counties like Pakistan there is a need to increase the supply of agriculture productivity growth somewhat increase in inputs (Ali,2005).

In the start of the 20th century the cultivated area will increase for the improvement of the crop production but not improve the agriculture production. With the passage of time the improvement comes in the technology and the main inputs were accessible by the end of the century, so due to the improvement the per acre yield were increase in Pakistan, and the production was also increased in the developing countries. Due to science-based system the production of agriculture sector improved. As well as the inputs were increased in the agriculture will reflect, the overall productivity was increased. If a country wants to achieve the macroeconomics objective so there is need to improve the agriculture output. Therefore, the major goal of Pakistan is the sustainable development in the agriculture sector, and it will increase only through with the agriculture productivity not through the increase in the inputs.

The present study finds out the effect of TFP of agriculture region on the GDP development of Pakistan. To calculate the TFP, time series data is utilized, because from the last few periods there is a decline in the agriculture output growth. Farming region is the major foundation for the economic growth of the nation. So, that why it needs more attention. Therefor the researcher examines the factor which effect the TFP of agriculture sector. The growth of this sector is very important, because it is the main contributor to the GDP growth of country, so that is why the following objective for the present research have been set and investigated.

1. To find out the TFP of Agriculture sector of Pakistan.
2. To evaluate the impact of TFP of agriculture sector on the economic growth of Pakistan

1.5 Significance of the Study

In Pakistan there is many issues with the agriculture sector. The government should make policies to overcome these issues, however all these policies are usually disregarded or not implement properly. In Pakistan there is 38.5 percent people working in the agriculture sector. And they produced goods for the people of the country to overcome the shortage of food as well as the industrial sector depend upon the raw material which is collected from the agriculture sector.

Preserving the current position of the agriculture sector, the significance of the analysis is to evaluate the effect of TFP of farming sector on the economic growth of Pakistan. Pakistan is a developing country, due to low productivity in agriculture sector the per capita income former is low, so in a result the poverty rate is increasing day by day. The agriculture productivity is increasing but with the low increasing rate so the in the result the wage rate is low in rural sector. Some country banned to import Pakistani product due to low quality so our exports decreases. It has an adverse influence on the economic development of the region. Significant goal of this research is to given attention to the agriculture sector by growing the output of the agricultural commodities, like increase the production of cash crops, livestock's etc. sector, which helps in the development of economic growth of Pakistan.

The lower agriculture growth is a big problem form last few decades. Its effects the overall economic growth, because it is the main part for the economic growth of Pakistan. 38.5 percent population depends upon on agriculture sector when the output of the cultivation sector is rises, then the income of rural will increase its cause the drop in poverty rate, rise in the manufacturing causes upsurge in the exports of the country, which is actual effective for the financial growth.

The agriculture development is not the only concern for the social and economic growth of the countries, the human being rights also matter. There is a traditional working condition in Pakistan. There is lack of modern technologies use in agriculture sector. Because it is very expensive and not afford by the mostly former because their financial condition was very poor. The Pakistan for cultivation the traditional method was adopt, low quality pesticide was used. So, in a result the growth was very low. There is need to improve the cultivation techniques by the use modern technologies etc.

Agriculture sector played usually very important role to ensure food security for the growing population of Pakistan. Pakistan is an agriculture-centered country, so the agriculture sector holds huge significance for Pakistan. But the share of the sector is reducing since its birth, the rise in the production of industrial sector has not removed the significance of the agriculture sector. Industrial sector cannot grow without the growth of agriculture sector because agriculture sector provided raw material to the manufacturing sector. So, it is necessary for the economic growth to increase capital use in agriculture, human capital in rural sector. If we want to achieve a sustainable development in that sector, so there is need of modern technology, high yielding varieties of common seeds like cotton, wheat, sugarcane, and grains etc. As well as make investment for the best irrigation system, for the agricultural research, and make sure efficient physical infrastructure.

1.6 Limitation of the Study

The study is conducted on Pakistan only. TFP of agriculture is not only the factor which determine the economic growth, there are other variables which determine the Economic growth.
Data of all variable took from Economic Survey of Pakistan, WDI and ILO from 1980 to 2018

1.7 Research Question

The TFP of agriculture sector is the main problem with all agriculture-based countries. The various countries have adopted different policies to overcome the problem of TFP of agriculture sector. The study significantly determined the impact of TFP of agriculture sector and how the government introduce policies to overcome this problem.
Questions of the research is given below

1. What is the total factor productivity of agriculture sector of Pakistan?
2. What is the impact of TFP of agriculture sector on the GDP growth of Pakistan?

1.8 Problem Statement

The goal of the research is to analyze the TFP of agriculture sector and GDP growth of Pakistan.

1.9 Hypothesis of the study

The core hypothesis of the study is given below

Ho: There is no significance effect of TFP of agriculture on the GDP growth of the country.

H1: There is significance effect of TFP of agriculture on the GDP growth of the country.

Ho: There is no substantial effect of capital stock on the GDP growth of the country.

H1: There is substantial effect of capital stock on the GDP growth of the country.

 Ho: There is no substantial effect of labor force on the GDP growth of the country.

H1: There is a substantial effect of labor force on the GDP growth of the country.

1.10   Organization of the Study

This research is divided in to six parts. part 1 cover introduction that provides agricultural growth and Pakistan's economy, composition of agriculture sector, sources of agricultural output growth, decomposition of productivity growth, solow's growth theory, structure of the remaining thesis, background of the study significance of the study, limitation of the study, objective of the study, research question, problem statement, hypothesis of the study, and the organization of the study. part 2 describes a short review of studies conducted earlier on the TFP of agriculture sector. It consists of two sections. Section one covers the importance and the improvement of the agriculture productivity and the study conducted by the national empirical studies. Section two covers the study conducted by the international empirical studies.

Chapter 3 describes the time series data of both input and output, for using in the estimating of TFP of agriculture sector from 1981-2018. The limitation of data source is also explained. And describes data source and descriptive statistics which cover introduction and economic survey of Pakistan. Chapter four Chapter 4 is divided in two parts. Part one discusses why we are using ARDL model, and part two discuss the theoretical framework techniques which is utilized in the second stage analysis to understand the impact of TFP of agriculture region on GDP growth of country. In that part stationarity and nonstationary concepts are describes briefly. And part tow explained the specification of the model used in the current study. It's also describes theoretical and methodology framework its cover introduction, econometric model, first stage analysis and second stage analysis. Section 5 describes findings and analysis and part 6 describes conclusion and policy recommendation.

Review of the Literature_____

This chapter contains the earlier studies which is already planned and related with TFP of agriculture sector and economic growth during 1981-2018. The review of literature produces several recommendations, concerning the TFP of agriculture sector and economic growth. And as well as it tells about how to do this. This chapter also describes the results of the main studies performed in Pakistan as well as conducted by the other countries. This chapter has been divided into two parts, section one describes the study which is conducted nationally. Section two describes the studies which was conducted internationally.

It is necessary for the poverty alleviate to increase the productivity of agriculture as well as to protect the food security. There is a need to increase the cultivated land and decrease the population growth rate, in our country as well as in the forming countries. There is also need of the sustainable improvement in the agriculture growth. Thus, the growth in the agriculture productivity is necessary to overcome the future challenges in the region.

Farming region is the core factor for the overall financial development, the sustainable agriculture growth is very crucial to decrease the poverty level of the country. So, there is a need to improve the agriculture productivity to achieve a sustainable economic growth. The agriculture productivity growth is necessary for Pakistan to reduce the poverty. Because there is clear impact of the agriculture on the entire economy of Pakistan. The advantages of this sector are that, it's the source food and raw material for the urban and rural sector.

Zaidi (1999) explain the importance of agriculture productivity, to eliminate the shortage of food and provide the food to the people of the country. He also describes that there is a need to increase the cultivated area, it helps to increase the agriculture growth of the country. But in a country like Pakistan, with the passage of time the cultivated area is decreasing, so that is why the agriculture growth is declining. The population growth is increasing rapidly so the requirement for goods is also growing with the passage of time. So, fast growth of the agriculture sector is necessary to fulfills the need of foods. There are many countries who got outpaced in their manufacturing sector Martin and Mitra (2001)

Saboor et al., (2006) described that the agriculture sector of Pakistan is facing problems in the 21st century, like food security and existence in the globalize world lower than WTO scenario. So,

it is crucial to maintain the optimum level of raw material and food demand for the growing population of Pakistan and to reduce the poverty in the rural masses. The need for food is growing rapidly given the short strength of per capita income.

In Pakistan few studies have been conducted for the estimation of agricultural sector TFP. The innovative one of them is the study Wizarat (1981). Wizarat took time series data (1953-79) to assess the TFP index in the growth accounting framework. As per the estimation of Wizarat, in Pakistan the TFP growth of agriculture sector is 1.1 percent.

In 1990s there is decline in the economy of Pakistan due to poor governance. The GDP growth rate go under to 4 percent and the Pakistan economy faced persistent fiscal and external deficit. Pakistan lost its market share due to low exports at that period. Poverty rate is almost doubled 18 to 34 percent. So, there is a need to emphasis the on the factors responsible for the performance, as well as the role of TFP growth in the process. So, it is clear to emphasis the performance of the entire economy not only the manufacturing sector.

Khan's (1994) arithmetic index is applied to calculate the TFP of the agriculture sector. TFP was recorded 2.1 percent. TFP of agriculture sector was estimated by Kemal et al (2002) by applying growth accounting approach. The TFP remained 0.37 percent pa. Ali (2004) also obtain the TFP of agriculture sector by utilizing the arithmetic index, and the TFP was recorded 2.17 percent annually.

Haque (1995) describe that in the manufacturing sector, the performance of labor productivity growth shows the strength of the country. He takes a sample of two growing countries for the period of 1970-89. He analyzed productivity growth with respect to test of Kaldor's (1967) and as well as with respect to Verdoorn's Law, which shows that due to law of increasing return to scale and technological development, there is positive relationship in these twos. But the finding of Kaldor for the industrial countries is stronger than the finding of Haque's. according to calculations of Haque's, there is a positive correlation between the productivity growth and the manufacturing growth.

Haque (1995) describes that the regression on investment rate of primary school enrollment and he explain the residual and noted the estimated value from the previous regression. But he didn't find the significant connection with the formers, because the differences among the country is

small. But he finds out the significant connection of the secondary school enrollment, but his claim is more important to the industrial sector. To describe the variations in labor growth the investment rate is an important variable. The finding of the Haque's study explain that there is no significant improvement in the descriptive power of regression.

Pasha et al. (29) describes that in the long run, there are many elements which affecting the TFP of agriculture. The result of his study shows that there is human capital increase the TFP from 1.6 to 1.8 percent annually. He determined the fast growing in the TFP of agriculture sector was due the increase in the productivity of the non-factor inputs. He also finds out that TFP will be increased to increase the investment in the education sector, particularly increase the primary as well as the secondary school enrollment rate.

Ali (57) by using Arithmetic and T-T index he calculated the TFP of the agriculture during 1960-96 in Pakistan. Throughout the whole period the TFP of agriculture remained 2.3 percent, and its contributions to the expansion of total productivity was 58 percent. The result analyzes that the TFP growth is the important component for the agriculture productivity. During (1965-70) in the green revaluation the TFP growth rate was high, and it was noted low in (1971-75).

Saboor, et al. (31 calculated the TFP of cultivation sector and he find out that there is an increase in the TFP, but he also finds out that there is an increase in a poverty rate was also during that time. He describe the reason by which the poverty was increase, the reason behind is that the rich former can achieved the highest TFP rather than by the small formers, he suggest that if we want to achieve a sustainable TFP then this issue should be eliminated from this sector.

Ahmad et. al. (1) describes the growing trends in the TFP of agriculture sector, and he took data from1950-2004. He finds out that the TFP of agriculture sector was 0.28 percent and contributes to the TFP of agriculture value addition is only 7 percent. He suggests that there is need to increase agriculture inputs as well as extend services to increase the growth of agriculture TFP.

Kiani et. al. (24 find out the TFP of sub sector of crop in Panjab, for the period of 1970-2004. The findings show that there is need of research, investment, increase the number of machineries like tractors, ensure the water availability by increasing the number of tube wells to achieve the sustainable agriculture growth in Pakistan. Empirical result shows in Pakistan there is desirable marginal rate of return to increase investment in that sector.

Sabir and Ahmad (31) describe that the agriculture productivity was increase at the rate 2.0 percent in 1972-2003. Ali also find out the that the TFP growth rate is increasing at the rate of 2.3 for the period of 1960-96. The estimation of Ahmed and Bukhari shows that the share of inputs is not substantial except for 1973-77, TFP can enhance the agriculture growth in the sector. They describe that the TFP of agriculture sector contributes 86.9 percent to the agriculture growth in1988-92.

Pasha, Ghaus-Pasha and Hyder (2002) in 1990s there is decrease in the agriculture TFP of Pakistan, there is a need to analyze those factors which caused the decrease in the agriculture output. Emphasize upon those elements which shift the growth of the economy upward rather than focus on those elements which shift the overall economy downward. In that time there is an only focus on the industrial sector, they describe the correlation between the TFP and the GDP growth. They also make a five-year plan for the period of 1972-73 to 1997-98, but the focus was go-slow in 1990s. They emphasize that if there is growth in the TFP in a result there is an increase in the GDP growth. They find out the TFP growth is 40 percent, accountable for the GDP growth of the country. The outcome of their studies suggests that there are variations in the TFP growth for the period of 1992-98. But Pasha et al, describes in his first study the importance of service sector, which cause the decrease in the TFP growth and the economic growth, but he didn't justify the bad growth of the services sector which is not as per the expectation.

Azhar (1991) according to the survey of farm taken by WAPDA in 1976-77 evaluate the impact of high yielding seeds on the agriculture output using cross sectional data. And as well as examine the influence of education on the agriculture output. By using Cobb Douglas production function shows the effect of various elements on the output of different crops. The estimation result shows that there is many factor which cause the TFP of agriculture, in Pakistan traditional method are used for cultivation, labor and cultivated area is reducing day by day, less efficient irrigation system, government should pay attention to provide the subsidize fertilizer to the poor farmers in the result growth will be higher than the expectations, in Pakistan formers are less educated so first increase their education level, less education level of former cause the decrease in the agriculture productivity and in the economic growth. In his study by a mistake he did not check the impact of capital stock, capital remains the important factor for TFP growth. The result suggests that for sustainable TFP growth of agriculture sector there is a need of high yielding

varieties of seeds, sufficient labor, increase the cultivated area, and educate the formers will increase the agriculture productivity.

Parikh and Shah (1994) describes that there is a need to increase the efficiency of input used in the agriculture sector. He estimates his study by the trans log production function in KPK by using the cross-sectional data of 397 firms from 1988-99. To check the efficiency of the farm he used stochastic frontier method as well as its measures the efficiency of different formers. Using OLS to regress the technical efficiency of the variables. He takes the family size of the farmer, check the literacy level of the family head wheatear he is educated or not, and how old he is, calculate age, worth of the farm assets, and value of those asset which is not connected with farm. The result of the estimation shows that the education level, family size and credit per acre has a substantial impact on the efficacy of the production.

Hussain and Ishfaq (1997) using OLS and take the time series data of variables from 1968-96 to examine the effect of the variables on the agriculture output to the extensive Cobb Douglas production function. For estimation he took crop area, labor, fertilizer, irrigation, and tractors used in the agriculture sector as an independent variable and all the variable is calculating in growing form. The estimation result shows that the crop region and the use of fertilizer in the farms have a major impact on the agriculture yield at the rate of 0.66 and 0.43 percent. By the fertilizer the efficiency of the farms rises. People can get more production where the cultivated area is lower. The estimation also describe that the farming growth shows increasing return to scale from 1968-96.

Ali (2005) by using the polynomial lag structure in addition to applied OLS approach, he finds out the effect of spending on the study of agricultural sector TFP for the period of 1960-96. The result shows spending on the research has a substantial and encouraging effect on agriculture growth of Pakistan. So, there is need to expand the spending in this sector. It will improve the production of agriculture sector.

Sabir and Ahmed (2008) calculate the effect of financial reforms on the agricultural sector TFP development, by using variance decomposition method. He takes agriculture, industrial, and services sector and take the time series data of their three sectors from 1972 to 2002. Human capital, fertilizer, food subsidy and cotton were the independent variables of the agriculture sector. The estimation shows that the human capital, fertilizer and food subsidy has clear relationship with

the agriculture TFP. human capital has the highest share of 0.54 cotton share 0.13 and the food subsidy has a share of 0.003. And there is a insignificant correlation between the fertilizer and the TFP of agriculture.

Chaudhry (2009) describes the TFP of agriculture sector from 1985-2005. Calculations of the industrial and agriculture sector done separately. The result of agriculture TFP shows that it contributes at the rate of 49 percent, the portion of labor was 40 percent the other components contribute at the rate of 11 percent. As compare to the agriculture sector the TFP contributes at the rate of 29 percent, labor contribution rate was 15 percent and the capital contributes 56 percent to the industrial sector. TFP growth for the economy is 1.1 percent annually, and this growth is assigning with growth of capital and labor. The conclusions propose that rise in the capital will enhance the agriculture output of Pakistan, and the same result will be coming in the developing countries.

(Datt and Ravallion) poverty will be decrease by increasing the agriculture of the country, because the rural sector depends on the agriculture growth as well as it is the most important source of income for those which relates to the growth rural areas. without the rural development the urban cannot be achieved. Industrial sector has also the performances a extremely valuable role to reduce poverty in the nations. Gallup et al., (1997) explain the connection of growth and poverty, he explained that if there is 1 percent rise in the agriculture growth then there is 1.61 percent rise in the income of the poor person. The growth in the agriculture productivity increase the income inequality and decrease poverty. Timmer (1997) describe that the agriculture growth decrease poverty and has not increased income inequality.

Gerdin (2002) during 1964-96 the TFP of Kenya agriculture was lower than 0.4 percent and with the time it was decreasing. In 1964-73 it contributes 10.1 percent and in 1988-96 its contributes 26.6 percent. According to the results the factor which cause the lower TFP is the lack of fertilizer, traditional cultivation methods and poor infrastructure in the farming sector of Kenya. And the investment rate in that sector is also very low. The method of estimation T-T index method was applied.

Fan et al., (1999) and Desai, (2002) they found that previous studies shows that the agriculture productivity growth was the backbone to reduce poverty in Pakistan and in these countries, which is still less developed. Mellor et al., (2001) indicates that the agriculture growth is key for the

poverty reduction as well as in the reduction of inequality. He explains further that the growth in the agriculture productivity decrease poverty in the rural areas because it is the source of income for formers. When the there is an increase in the agriculture productivity growth the they can earn more so the poverty will reduce, and then they cannot migrate to the urban areas. If there is increase in the agriculture products will decrease the prices of food so it is better for the people of urban and rural sector. It provides employment to those people, which is connected with the rural sector. If there is increase in the agriculture productivity will result empowers the people of the rural sector. So, the studies suggest that when there is an increase in the agriculture growth, it will reduce poverty in Asia. In India the industrial growth causes the poverty increasing and the agriculture growth reduce poverty Warr (2001).

The continues supply of food explained that the agriculture sector is still the largest source of food Federico (2005). The world population had increase form about one billion to more than six from the last two centuries, according to conservative estimate the production of agriculture sector has increase 10 times. This increase has possible the availability of food to the growing population, as well as the better the nutritional standards. As compare to the traditional societies almost people were suffering from the undernourished and starvation. In fact, the agriculture productivity growth is necessary for the future of the people. It is impossible to reduce under nutrition without the agriculture output growth, and to handle the population which will be 9.6 billion in 2050. In the country the demand for food is increasing rapidly, and there is also a decrease in the per capita income level.

Evenson and Pray (1991) to estimate the average growth rate of TFP used annual tie series and cross section so the result was 1.07. Its marginally lower than the result of Wizarat (1981). Rosegrant and Evenson (1992) as well as finds similar estimations as find by the Evenson and Pray (1991) but there is only one difference in their estimates is T-T index. In 1957-85 TFP is based on T-T index. However, the estimation of sub periods is significantly dissimilar from each other.

Fernandez-Cornejo and Shumway (1997) Describe the agriculture productivity of the Mexican during 1940-90 and its relationship with the agriculture research. First T.T index is used to find out TFP of agriculture sector. The findings demonstrate that agriculture research theatres a vital role in the agriculture TFP growth, he suggests that increase spending on the agriculture research to increase the agriculture productivity. Second, cointegration methodology is used to get the long

run connection with the TFP growth. The outcomes suggest that there is a requirement of technology for the Mexican agriculture. For estimation he used the productivity of agriculture sector to find out the output. The result show that the due to the agriculture research the estimated share of agriculture sector is 64 percent.

Makki, Thraen, and Tweeten (1999) took time series data to describe the agriculture growth of U.S, the data of investment, literacy rate of the formers and trade, was taken for estimation. The result shows the significant impact of research and investment for the agriculture growth. The result of the estimation show that the share of research and development is 6 percent and 27 percent in the public research extension.

Rosegrant and Evenson (1993) describes the TFP of agriculture crop sector of Pakistan, he discovered the variables of the research, and introduce the innovative brands, and as well as the literacy rate of rural sector, and the irrigation system has an excessive importance in the agriculture TFP growth, the finding shows that the specific return of the investment in research was 58 percent, the return of overall research was 39 percent, the return on particular was 53 HYVs. The result suggest shows that there is a need of research of agriculture sector to improve the agriculture growth.

Muragi et al. explains to evaluate the TFP of India's agriculture sector, and in Punjab Pakistan during 1996-94. The share of agriculture of the agriculture sector of India TFP was 1.9, the production growth was 5 percent. The productivity of agriculture sector is better than the agriculture productivity of Pakistan. The agriculture output of the Pakistan was 1.2 percent, the increase in TFP was 1.6 percent. the result indicates, the agriculture region TFP of Pakistan was showing a problem of soil deprivation. The result also finds out the things which is contributing the TFP of the farming sector. here is a certain impact of investment and agriculture study, by which we investigate or can build better roads, increase literacy rate and provide subsidy to the poor formers.

López-Calyx, Srinivasan and Waheed (2012) describe the drop in the TFP of the agriculture sector for the period of 1990-2010. He analyzes and explain the impact of capital, land, human capital and TFP of labor, for three periods during 1980-2010. As well as the study includes the important sectors like agriculture and industrial and services. The finding of study is that the capital

and labor has perform a critical part in the TFP of farming sector. The survey also suggests that there is requirement to increase the investment and efficient worker for agriculture sector.

The growth of TFP has been decreasing in 1999s, so he finds that is period of trade liberalization. The decrease in the TFP was not cause by the trade liberalization, it is caused by the poor economic reforms and the failure of poor policy making by the policy makers, he claim that the agriculture TFP is declining, and in Pakistan there is a need to improve the economic reforms and better economic policies. The TFP of agriculture sector decrease in 2000-10, the study suggests that there is a need of such economic policies which is better for the agriculture growth. As well as It will the increase the economic development of country.

The studies show the agriculture productivity of Pakistan, is showing a decreasing trend, the growth rates were decreasing over the time, the labor productivity was decreasing, there is need to discover the factors that's decrease the agriculture TFP of Pakistan. So, there is need to increase the agriculture inputs, which would help to increase the agriculture growth. In Pakistan, there is a shortage of better policies for the agriculture sector. So, improvement will be needed to make better economic policies, it will enhance the agriculture efficiency of the country. Conclusions declares that the reforms give a modest effect on the agriculture efficiency of Pakistan, when the agriculture output is increasing then it will improve the economic development of the country.

Several studies related to productivity reinforced that a significant part of production growth in advanced economies is ascribed to TFP growth (TFPG). Tinbergen B (1942) and Solow (1957) analyze the economy of U.S for the period of 2019-20, they find out that the technical progress maintains substantial impact on the TFP growth. Fabricant (1954) and Solow (1975) explain that the economy of the U.S productivity has not been described by the inputs utilized in the output. Kennedy and ThirwalJ12 (1972) also presented similar findings for other countries.

Evenson and Jha13 (1973) attempted to measure the contributions of agricultural research systems to real productivity in India. They concluded from in-depth study that TFP gains have not accrued evenly over the country and brought regional disparities over time. Further, they found that TFP gains have not been associated exclusively with wheat and rice production or with the extent of irrigated acreage. According to their findings the agriculture growth has been increased in that period, the reason behind is that is there is a rise in the investment and research of India, in the result the production of the agriculture will rise, it will increase the GDP growth of the country.

It is statistically pointed out that when there is an increase of investment in the agriculture sector, in a result it will increase the production of the country in the development activities.

Christensen14 (1975) compared the merits and demerits of different indexes as used by different authors for expressing production functions. In summing up discussions, he opined that in contrast to the assumption of perfect substitutability is the case of linear function, the Tran slog function didn't require any inputs for the perfect substitutes. Accordingly, he recommended the advantages of Tornqvist Divisia index for use in analyzing most production situations. Diewert15 (1976) utilized the word "superlative" to describe the index numbers, which is accurate for production functions having this calculation feature. Such production functions are flexible in nature because they can approximate production structures with arbitrary substitution possibilities.

Antle and McGuckinl jointly made a research work upon the agricultural output, in United States and then extent the technological innovation in agriculture but after that in the twentieth century. They have concluded those facts by which the innovation of technology in USA were developed through a system of public and private research and were disseminated through agricultural education and extension and private marketing of agricultural inputs. Further, they have noted that technological innovation in the United States has been biased toward the development of technology that has exploited abundance of land and capital, as a result the technology developed in United States has typically been land using, capital using, and labor saving.

BalF7 (1985), constructed the Tornqvist-Theil indexes for outputs inputs and measured the output productivity over the postwar period in U.S. The productivity indexes were resulting after the flexible multi output and multi factor represents the structure of production-the trans log production function, from controlled to constant return to scale. He used the following index proposed by Orristensen and Jorgenson of factor productivity growth (TFP).

Bramhananda18 (1982) investigate the TFP of agriculture sector of India takes output of crops and livestock sector. His findings surfaced that the agriculture productivity of the country is increasing with the rate of 1.5 annually during 1950-60 but the agriculture growth is decreased during 1970-71 and 1980-81 at the rate of 0.8 percent. After studying other sectors, he, further observed that TFP growth rates have moved down universally.

Rosegrant and Evenson20 (1992) describe the TFP growth of Pakistan, India and Bangladesh crops, during 1957-88, They observed that in India, TFP increased quite gradually over fluctuation due to weather variation. Further, they commented at variation in TFP around the trend has been to the variation fill out. The input used in the agriculture sector is increasing over the time, so in a result the output, will also increase annually by the rise in the agriculture inputs. In India the output growth is recorded one-third of the aggregate output development of the crop sector,

Bhattacharya21 (1992) attempted to quantify that due to technological change there is an increase in the agriculture output of the Uttar Pradesh for the period of 1950-66 and from 1966-88. His study determined that irrigated prone areas gained much from the modern machinery comparing to non-irrigated areas.

Saha and Swaminathan22 (1994) estimated the growth in aggregate output of agriculture in West Bengal, which was based on an index of total output covering the ten-year period from 1981-82 to 1990-91. Their district wise results revealed that apart from Jalpaiguri and Darjeeling the index of the production of aggregate crop grows at the rate of 5 percent yearly in the district of west Bengal Further, they observed that estimates of growth did not change substantially when adjustments for weather were made.

Evenson, Pray and Rosegrant (1998) analyzed the agriculture growth of as well as the agriculture research of the India. According to them, India has made significant gains in TFP. They concluded that adoption of modem varieties is not the only source of increase in TFP. According to them, the public-sector research and there is extension in agriculture research, is a major source of TFP growth.

Rosegrant and PingaIi (1994, studies the prices of rice, investment made in research and irrigation as well expenditure on providing high yields seeds and fertilizer to the former. The result show that there is decrease in the prices of rice, there is lack of research in the agriculture sector, there is lack of investment to provide high yielding crop and fertilizer as well the fertilizer system is not as per the requirement. So, it causes the decrease in the TFP of agriculture sector, there is to upgrade all those inputs which is connected with the agriculture growth. Educational stock would be the main determinants to increase rice production in Asia.

Jahan45 et. al. (1996), made a joint effort to investigate to 1992-93, the TFP of agriculture sector of Bangladesh, he analyzed that the agriculture sector is mainly depend upon on the crop sector during 1947-93, employing time-series data. Using the Tornqvist-Theil index to evaluate the TFP of agriculture, he also took the impact of recent policy changes, Jahan concluded that there is need of invest in the agriculture research to find the problems associated with the agriculture sector as well as the use of modern technology is the most significant factor of TFP.

Rosegrant and Evenson46 (1995), tried jointly to assess the growth of TFP in India during 1956-87, to examine the sources of output growth, he also includes the private and public investment, he estimates that what will be the return of public investment in the agriculture sector. The outcomes indicate that there is a substantial TFP progress in the crops of India (five key crops and fourteen small crops included the output index) was generated by investments, to improve the irrigation system and also there is a need of research in the agriculture sector. According to them, the high-level of return, is especially due to public agricultural research and extension as well as involvement of the Government support in field of agricultural research and extension. Further they advocated existing levels of public financing could preferably expanded.

Some other studies which is related to the research is presented in the form of table 2.2

Table 2.1

Characteristics of the other Research Review

Writer	Time period	Techniques Used	Findings
Jayne et al., (1994)	Zimbabwe 1975-90	Profit Function Approach	The result shows that there is a drop in TFP growth due to the decrease in the investment and loans in late 1980s.
Cameron et al., (1996	Canada, U.S.A, U.K, W. Germany	Canada, W. Germany	The result shows that there is negative connection with total factor growth and inflation.
Sing and Trieu (1996)	Japan Korea and Taiwan 1965-91	Trans logarithmic Value-Added Production Function	Sing and Trieu (1996) find that the impact of TFP is 50,29 and 45 to the overall output

			growth of Japan, Korea and Taiwan. The study shows the importance of physical capital for the TFP growth.
Cornejo and Shumway (1997)	Mexico 1960-1990	T-T index number, and Cointegration analysis	If there is an increase one percent in the research investment the TFP increase by 0.13 percent, and if the TFP of US increase by one percent result the TFP of Mexico agriculture were increase by 1.11 percent.
Fantino and Veeman (1997)	Canada1962-91	T-T Index Number	The estimated TFP growth of the Canadian agriculture was 1.88 and 1.92 percent annually.
Edward (1998)	93 Countries 1960-1996	Aggregate Production Function (APF)	Edward describe that the causes of TFP growth were institutions, politics and macroeconomics stability. That is why the opened countries achieved the faster productivity growth.
Muragi (1999)	India 1960-1993	T-T Index Number	Muragi explain that during green revolution the TFP growth was low and rise later. There is a need to improved resource management and investment in infrastructure will increase the productivity.

Martin and Mitra (2001)	50 Countries 1967-1992	Cobb-Douglas Production Function	Martin and Mitra describe that the agriculture growth was 0.54 percent, it was higher than the manufacturing sector. Thirty countries did well for the TFP growth as compare to the US agriculture. The finding indicates that there is declines to make better agriculture policies which is favor the agriculture sector as compare to manufacturing sector.
Fu (2002)	Taiwan 1965-1999	Growth Accounting Framework, Least Squares Regression Method	Fu explain that the main factors of TFP growth were research and development, exports and imports, investment and the industrial outflow. The finding recommend that the free trade policy resulted in the TFP growth.
Mamatzakis (2003)	Greek in 1960-1995	Dual Cost Function Approach	Mamatzakis defines that there is substantial effect of public services financing on the TFP growth. The productivity of livestock and crop production was increases. His analysis explains that the decline in the public infrastructure investment declines the TFP

			growth of Greek agriculture during 1980s.
Umestu et al., (2003)	Philippine in 1971-1990	Malmquist Productivity Indices	Umestu et al defines that the agriculture production was increase due the introduction of new seeds varieties like rice. The factor which is affected TFP growth is low investment in irrigation, adoption of tractor and the high population growth.
Ma et al., (2004)	China 1980-2000	Coefficient Frontier Approach	Ma et al define that the production of meat rises due to rise in input level and TFP growth. The technological progress is the main factor for the TFP growth. The most important factor to increase the china livestock TFP is to improve the livestock feeding techniques.

Note. Features of the other research review

2.1 Summary

Section two describes Review of National Experiential Studies and review of international experiential studies regarding the estimate of TFP growth. In this chapter the study has estimate total factor productivity through nonparametric and parametric technique, growth accounting framework, and Tornqvist Theil index number technique. The review of the literature shows a mixed trend among the developing and the developed countries in total factor productivity. The has conducted regarding this subject in Pakistan by Azhar (1991); Rosegrant and Evenson (1993); Shah & Parikh(1994); Haque (1995); Hussain & Ishfaq (1997); Wizarat Khan (1997); Ali and Byerelle (2000); Pasha et al (2002); Sabir and Ahmad (2003); Saboor, et al; Kiani et. al (2008)

Ali et al (2005); Sabir and Ahmed (2008); Chaudhry (2009) emphasis the role to do research in the agriculture sector. Khan (2006) Ahmad and Bukhari estimate the total factor productivity growth but given little weight to the agriculture sector.

DATA SOURCE AND DESCRIPTIVE ANALYSIS_____ __

Chapter three defines the data source and the required variable utilized in the study. To obtain the TFP of agriculture region, time series data have been utilized for output production and the inputs utilized in the process of agriculture productivity. Data of different variable were collected to assess their impression on the agricultural TFP growth in Pakistan. The study covered the sample from 1980 to 2018.

3.1 Introduction

This section describes the data and descriptive statistics of the study. The economic analysis is depending upon on the availability of the suitable data. The measurement of total factor productivity growth is not an easy attempt in the developing countries, because in the best conditions we may not have been able to get the sample data with which to progress. In the present study in this regard the same situation was faced to collect the data. It is not the easy task to get the data of the variable on macro level, therefore no work has been done to measure, how TFP of farming sector effect the economic enhancement of the country. If we would like to decrease the problem like food security, high population growth, and to achieve sustainable agriculture growth by which we can increase the GDP growth of the country, so there is a need to take initiatives in research areas.

To estimation the TFP of agriculture sector, the times series data of labor, capital and land are required. The study covered the sample from 1980-2018. In this study the data of capital formation utilizing (perpetual Inventory method) were taken because, in the national income accounts there is lack of the data on capital stock. Data of cultivated area, labor and capital formation from 1980-2018 was collected from the Economic Survey of Pakistan and FBS, GOP, Islamabad. Data of fixed capital stock formation is calculated in millions of Rupees constant element, the labor force in calculated as a total labor force employed, and land input is measure cultivated land (as a percentage of cultivated area).

3.2 Economic Survey of Pakistan 2018-19

It investigates the whole performance of the Pakistan economy. It describes the major growths in the various sector of the economy, and it reviews the policies and reforms taken by the government throughout the year.

Economics Survey of Pakistan described that targeted growth rate for the fiscal year 2018-19 was 6.2 percent but they can achieve a subdued growth of 3.29 percent. The target set for the agriculture sector was 3.8 percent, industry 7.6 and services 6.5 percent during that period. But in the result, the agriculture sector can achieve the growth of 0.85 percent in the agriculture sector, 1.4 percent in the industrialized sector, and services sector can achieve growth at the rate of 4.7 percent.

Some major crops show a decrease in their growth, the output of cotton, rice and sugarcane show a decline trend. The growth rate of cotton declined by 17.5 percent, rice declined by 3.3 percent and sugarcane dropped by 19.4 percent. Wheat and maize show a growth of 0.5 percent and 6.9 percent. Due to the rise in the output of oil seeds and pulses, the other crops show the increase of 1.95 percent. Due to the drop in the production of cotton, the production of cotton ginning decrease by 12.74 percent. The output of livestock sector was increased, so that is why it shows the increase of 4 percent. The forestry sector also shows a growth 6.47 because there is an increase in the demand of timber in the Khyber Pakhtunkhwa.

3.3 Agricultural Output Index

In the current analysis, the output index was contained to estimate the TFP of the agriculture sector, it consists on the livestock and crop sector. Two sectors forestry and fishing were not including in the study, because their share is insignificance in the gross domestic product. Output index includes the main crop and livestock, fruits, vegetable and livestock products. The detail of different crop and livestock are as under

Cereals: consist on wheat, rice, barley, jawar, maize and bajra. Cash Crops: consist on sugarcane, cotton and tobacco. Pulses: consist on gram, mung, mash and masoor. Edible Oils: consist on groundnuts, sunflower, safflower, soya bean, and linseed. Condiments: consist on onion, garlic and chilies. Fruits: consist on mangoes, citrus, banana, apple, guava and dates Vegetables: consist on potato and tomato and Livestock: comprise on milk, beef and mutton. The poultry sector is the rising sector and as a main supplier to the production of meat.

To analyze the farming sector of the country, the was taken from economic survey of Pakistan and from WDI. Data of these variable is available in different units for example in million, thousand tones, and in tones.

3.4 Agricultural Input Index

The agriculture input used in the study are land, labor and capital. The data was accumulated from the PBS, WDI and ESP. To build the agriculture input index the data of land, labor and capital were required. In the input index the time series data of price were not available. So that is why those variables were not including to estimating the TFP of farming region.

Land is treated as an input similar to cultivated area. Took the yearly time series data of labor from economic survey of Pakistan. The value of land is measure in term of annual rental for example per hectare value in the form of rupees. From the farm management survey, we obtained the annual land prices and the data of major crops were obtained from Agriculture Prices Commission (APCOM), Islamabad. In the present study the data of land input is used in thousand hectares cultivated area.

In the present study, took the data of labor force from Economic survey of Pakistan. but those countries which is less developed like Pakistan the data collection is still at the immature stage, it is difficult to collect data of working labor force. In Pakistan the data is available as a people working in this sector.

Use of capital stock as a input is more important in the agriculture production. Capital assets come in in the production of agriculture by the adaption of productive services. From the measurement of productivity, the evaluation of flow of services coming from the capital stock is further useful than capital stock themselves. But to estimation the capital stock there is problem, the first problem related to the land, because land is used as input in the study, but it is related to capital stock. Ball (1985) used farmland as a capital stock of US agriculture. The argument is that the land is a scare resources, but in the developing countries the land is used as separate input in the agriculture productivity. The second problem associated with capital stock is the reverse propensities in the output capacity of strong working animals and machinery etc. So that is why this make difficult the total capacity of actual capital. The depreciation pattern was also different from each other not only in the types of capital but as well as in the specific items.

In the developing countries like Pakistan, those economies which is less developed, the data of the capital inputs is not consistent and wide. So that is why it is difficult for the estimation, to which inputs will included in the capital stock formation for the agriculture sector. Due the limitation of the data in this area, therefore in Pakistan the calculation of capital stock is on the basic stage. In Pakistan different researcher applied different method to measured capital stock in agriculture.

The present study conducted by the researcher used the quantity of farming equipment's consume (diesel), tube wells consume (electricity), and how many draught animals have being used as an input in the capital stock. These all are contained in the capital stock. And we take the data of capital stock formation. Which includes the data of every variable (tractors, working animals, tube wells) were not collected separately. For the calculation of equipment (stock of tractors, tube wells and working animals) the perpetual inventory method were utilized. The data of tractor working in that sector, tube wells and working animals were accumulated from Pakistan Agriculture & Statistics.

The capital stock characterizes as the sum of flow of accrued investments over time after considering devaluation. The Jorgenson's perpetual inventory method (Jorgenson, 1974) is the finest method for the compute the balanced capital stock, while it have being continually replaced and at the same time also enhanced by additional investment and due to depreciation it is decreasing at the similar time. In this method, capital stock is calculated, which claims that the capital stock is the way to the increase the flow of past investments.

Jorgenson, (1974) the capital stock represents the sum of total investment but taking depreciation into account. The capital stock is calculated according to the Jorgensen's perpetual inventory method, says that capital stock is collected from the earlier investment.

$$k_{t=}I_t + (1 - \emptyset)k_{t-1} \hspace{3cm} 3.1$$

In the above equation the k_t is the existing year capital stock, $k_{t-1}$is the last year capital stock, I_t denotes the new investment and $\emptyset$ shows the deprecation rate. For the implementation of this method the data of capital stock are require. And the time series data of new investment in every year and the depreciation are require.

3.4.1 Intermediate Inputs

Pesticide and fertilizer are the important intermediate inputs of the agriculture sector, and they cannot be ignored from current study on the production of the agriculture growth. Throughout the green revolution this was the main factors for the agriculture production. But some studies did not use these inputs when they are constructing the input index, they take only fertilizer and don't take pesticide in agriculture. In the post Green revolution these inputs have increase a very fast growth in agriculture sector. A study did not estimate a reasonable result of the TFP of agriculture sector, if these inputs were ignored.

3.5 Descriptive Analysis

The agriculture TFP of Pakistan was calculated by Tornqvist-Theil (T-T) index method. In the growth accounting method, a change in TFP indicates there change in production, but this cannot account for the changeover in all inputs. The Same As the result, the TFP reflects the combined effect of many things, i.e. institutional factor and weather factor. If we look the other countries TFP growth experiences, the researcher found that there is a factor like human development, physical development (infrastructure improvement), credit resources. Technological advancement and trade openness (in term of import and exports) had a substantial impact on the agriculture TFP growth. The researcher similarly found that if a country like Pakistan want a sustainable growth, so they should emphases on these issues. Without the resolving these issues the sustainable growth is not possible.

In Pakistan it has been describe that the research on the variable which effect the TFP of agriculture sector has not been conducted separately. So, the main aim of the study is to identify variables which effect the TFP of agriculture sector. In the current study those variables were used, who has a direct or indirect influence on the TFP growth of the farming sector. Various methods are used to obtain TFP of agriculture sector is given below.

3.6 Approaches to Measure Total Factor Productivity (TFP)

This part describes the theoretical structure of the study and explain different approaches by the use of those we find the agriculture TFP growth. This section also describes different measurement issues and compare with different approaches. This section also make attempt to evaluate methods and give reason for using the methods.

3.6.1 Total Factor Productivity (TFP) Measurement and Concept

Importance of agriculture in economic development has long been noted by many well-known economists and these relations is quite clear. According to Robert Solow (19570, Solow describe the problem which is associated through the Cobb-Douglas production function Y=F (K, L) Y denotes the total production, K represent capital and L represent the total labor force.

This approach analyzes the output growth by the change in the technology and inputs. The beginning stage of this method is the Neo-classical production function, where Y=f (K, L)

Where we can also determine the economic growth by the adding factors inputs e.g. human capital (research institution that provide high technical knowledge) and agriculture growth in the model. The agriculture growth is important for the development and that is why it is the major interest for the research of the past decades. In (1957) Solow introduce growth accounting framework. By using this approach, we can find out the TFP and the part of that growth which was not describe by inputs e.g. land, labor and capital. The economists find out the agriculture output and describes the agriculture growth of the time as well as they compute the agricultural productivity of different t regions or countries. The agriculture is necessary to fulfill the demand of food of the increasing population as well as very crucial for the GDP growth of the country. The concept of TFP is easy then the technological change so the technical progress is the common measurement.

There is two components of the technical improvement, one is the technical change and the second is the technical improvement. The improvement in the production process discussed by the previous studies. So, due to this we can get the best process to find out the growth. TFP of can be raising with the help of technical changes. Yanrui (1995) describe that there is an increase in the technological efficiency will increase the industrial sector as well the use of technology will enhance the agriculture growing of the country. Technological progress is the essential factor for improvement of the country. The major factor of technical progress is human capital, best infrastructure, use of capital, financing in the research and development, in addition to increase the literacy rate. The above mentioned was the key factors for the TFP growth.

The productivity of the sectors is the major factor for the economic growth and the growth of industrial sector and farming sector in key for the advancement of the country by Kuznet, (986) and Evenson and Jha (1973). Lewis (1978) describe that when the growth of all sector increasing with consistency, the it will enhance the overall growth performance of the country. Uses of modern technology is main factor to rise the GDP growth, because without the technology, growth

cannot be achieved. Since the work of Schultz, Solow and Griliches different method of growth has been explained and with that the production will increase.

3.6.2 A Review of the Main Total Factor Productivity Measurement Methods:

Methods to find the total factor productivity is explain in this chapter. Two method are used to find the TFP, one is the macro level and the second is the micro level. In a macro level method calculate the aggregate which is related to the county or the production of the industrial sector. micro level method explains to find out the productivity of the firm and plant. And it is not important to analyze all the methods which is related to the micro level, Van Beveren (2012) and Del Gatto et al, (2012) conducted complete surveys on these methods. To find out the result of the panel the use of macro level method is not appropriate.

The reason behind is that in the macro level method the economy is considered by only one sector or for estimation in this method take only one sector. So, that is why it is not suitable for the those which has different sectors, it can be rotting into firms. Every firm has a different feature, their production process is different from each other, the inputs used in firm are different as well as TFP. So, that is why the macro level methods is not better for those firm where there is the existence of heterogeneity. And the micro level method has a different quality, the TFP of the firm is different among the firms. And it is suitable for those sectors where there is the existence of the heterogeneity. In the micro level methods, the first techniques of estimation are the ordinary least square method known (OLS)

Ordinary Lease Square Method (OLS)

The explanation of OLS is come with by the discussion of the main methodological issues arising in TFP estimation.

The subsequent justification is implemented from the work of Van Beveren (2012). He estimates the TFP by using OLS, he uses the following production function,

$$y_{it=}A_{it}\,K_{it}^{Bk}\,L_{it}^{Bi}M_{it}^{Bm} \tag{2.1}$$

In the above function, Yit denotes the productivity of the firm i and t denotes time, Kit denotes the capital input, Lit denotes the labor input, Mit denotes the intermediary input, like seeds fertilizer etc. and Ait represents total factor productivity. βk, βl and βm denotes the elasticity of

output with respect to capital, labor plus intermediary inputs, correspondingly. Applied the natural log on the both side of the equation.

$$Y_{it} = B_O + B_k\,K_{it} + B_l l_{it} + B_m m_{it} + \varepsilon_{it} \qquad 2.2$$

In the equation TFP is given by:

$$lnA_{it} = \beta_o + \varepsilon_{it} \qquad 2.3$$

The function has been separated into β_0, denotes the average effectiveness level of the production, and εit, denotes the sector change from this average. When the efficiency level of the firm is negative, it shows inefficiency of the firm. εit can be further divided into two elements: vit and uit. vit is the TFP that is observable, if there is an entry and exit in the firm or if the wants to make his choices. It can be denoted by the result of the TFP from the different managerial methods, uses of machinery in the agriculture sector and strike of the worker. uit is an unobservable element which denotes a measurement error or an unpredicted output shock. It cannot be observed by the firm or by the agriculture sector if he makes choices or if the firm decided the entry or exit because it is unpredictable. By using the decomposition of εit into vit and uit, the last function come to be:

$$y_{it} = \beta_o + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + v_{it} + u_{it} \qquad 2.4$$

Where:

$$lnA_{it} = \beta_o + v_{it} + u_{it} \qquad 2.5$$

The Agriculture sector examined TFP is given by the average productivity level β_0 and the noted component vit of the deviation εit from this average.

$$TPF \equiv \omega_{it} = \beta_o + v_{it} \qquad 2.6$$

The estimation of OLS find out and the residual represent the level of productivity which is not attributes the capital, labor and inputs

$$TFP = \omega_{it} = \beta_o + v_{it} = y_{it} - \beta_k k_{it} - \beta_l l_{it} - \beta_m m_{it} \qquad 2.7$$

To find out the level of TFP by solve ($\omega \hat{\imath}t$). The OLS method is used because it has a practical advantage, OLS technique is the only suitable, regardless its attritive fraction, if the inputs are

exogenous properly. It shows that the inputs used in the production are use independently in the TFP of the firms. In the agriculture sector the decision maker makes the choices according to the several reasons, including them and being the observable element of TFP, then the assumption of the input, the exogeneity is very strong.

Marschak and Andrews (1944) describe that the inputs are defines in the sector not exogenously. So, it indicates that the input use int eh production is defined as per the observable portion of the TFP, and himself manipulated by the selected inputs. So, there is a two-way correlation between the inputs and the productivity, it is making a simultaneity or the issue of endogeneity. The endogeneity is due to the inputs and has a correlation with the $\hat{\omega}_{it}$. To ignore the problem while estimate OLS indicates that the estimation in not consistent and biased. In this case, the bias is known as "endogeneity bias" or "simultaneity bias."

To estimate the TFP, there is a problem and necessary to be studied. There is lack of the data of physical inputs as well as the there is an unavailability of the data of outputs and their prices.

A second issue concerns when the production of different. There is a difference in the technological production and their demand. Bernard et al. (2009) describes that most of the firm use the same technology and the demand of their products are also same, so he suggests that it is due to the biased estimation of the TFP. So, if to make sure the consistency in the estimation then there is need of the data, of single inputs and outputs. After that it shows the technological variations among the firms and can produce the different outputs. Van Beveren (2012) says that according to the assumption where the firm can produce a single output, it leads that the TFP is underestimation.

Third problem to estimate the TFP Ackerberg et al. (2007) explains that if the firm get their output before the leaving of the industry, so there should be a connection between the capital and the productivity of the company. If a company has huge capital but its productivity is low is like to survive, as compare to the firm which have the lesser capital stock. So, due the adverse connection between the capital stock and productivity the selection bias makes the decreasing bias, with the coefficient of capital input.

This section is about to describe the issue which accruing to find out the productivity. The studies explain that to the estimate the productivity the following biases should be followed, in the

production the endeneity y of the variable should be checked, the absence of the inputs and output price of the firm, and the lack of the data of single inputs and outputs

Parametric Approach of Total Factor Productivity

Parametric method is centered on the econometric assessment of the technological production, including time in the production function. To estimate the technological changes, take partial differentiation with respect to time. Assuming extended Hicks Neutral technical change, for the Cobb Douglas production, then it would be represented by.

$$Q_{t=}A_t X_{1t}^{\propto n} \ldots \ldots \ldots \ldots \ldots X_{nt}^{\propto n} \qquad where\ A_{t=}e^{\propto nj} \tag{2.8}$$

The equation 2.8 A stands for the productivity index, Q is output, and X represent the inputs. The productivity growth can be measured as under the constant returns to scale is.

$$\frac{\partial TFP}{\partial t} = \frac{\partial ln A_t}{\partial_t} = \propto_0 \tag{2.9}$$

This measure is based on the productivity change in the production function, and the result of the duality theory make it possible to find this from the cost and profit function. For the production decision the cost function allow the endogenous treatment to the input prices, but the production function method does not allow to take endogenous treatment for input prices. However, there is some statistical problem with the estimation of direct cost function, the subsection of output is stochastic and there are many independent variables. The unavailability of reliable price data the function may not be feasible in this situation. The profit function estimation is feasible in that situation when the good price data is available because we suppose that the independent variables are exogenous. As well as the right-hand side variable were suffering from the endogeneity, when the production function is single.

Growth Accounting Approach

Growth accounting approach is used to obtain the shares of different elements in the economic growth and implicitly find out the technological growth rate, measure as a residual in the economy. The growth accounting is utilized to decomposes the economy growth rate into that which is due to increase in the contribution of the factor used. If there is a rise in the capital and labor and it cannot be counted by the change in the factor utilization. The part of GDP growth which is not explain is taken to increase the productivity.

Growth accounting technique is used in every economy of the world and the conclusion is that the GDP growth is not only explain by only the change in the growth of capital stock and labor force or population growth rate. There are several factors, which contributes to the economic growth and as well as to the economy. The role of the technological advancement is the key for the growth, without the use of modern technology the sustainable development t is not possible.

Christensen (1975) explain that in the growth accounting approach, the technological progress is shift with the calculation of factor productivity indices, mostly the rate of adjustment of TFP indices. Griliches (1994) explain that the early studies in the growth accounting tradition there is much effort to finding explanation for the residual, without any embarrassment, as well as the findings of our ignorance. With the technological change and change in the productivity of the input use it was due to the efforts to identify the residual. The residual, therefore, is not just a worthless that could be wanted away if one have better data, but is seen as a useful way of taking organizational and technologically-induced efficiencies that in effect constitute the and it could be core of the growth process, whether for part or for a whole economy

Griliches (1994) there are much step taken to explain the term residual term by some, in the earliest tradition of growth accounting, but certainly not without some discomfiture, as a measure of our ignorance. So, it was due to earlier effort for finding the residual in time, came to be identified with the technological changes and change in the efficiency of the input use. So therefore, the residual is not just meaningless that could be wished away if someone have better data, but it is seen as a better way of taking organizational and technologically-induced efficiencies that can affect the overall growth process, whether for the whole or some part of the economy.

Non-Parametric Approach

Chavas and Cox (1988) describes the implicit linear disparities that the firm must fulfill for the profit maximization and the cost minimization and by utilizing linear programing they find out the technological change. Data Envelopment Analysis lies in this group. The methodology of DEA is linear programmed, and it use the data of input and output different quantities and different countries to make a linear production function. Coelli and Rao (2003) using the same to make the Malmquist TFP index for the agriculture sector. But the growth accounting technique is common, the reason behind is that, the calculation of this approach is very simple, there is no need of data and the econometric estimations. In 1976,1978 Diewert demonstrated that for the linear

homogenous trans logarithmic production function the Theil Tornqvist or Divisia is consistent and exceptional.

3.7 Early Work and Contribution of Present Study

There is a difference between the current study and the previous studies conducted in Pakistan. The earlier study differs from the current in the analysis of input and outputs, procedure for estimating inputs, to estimate the TFP the indexing method has been used, and the level of disaggregation. So due to these differences it is difficult to get a significant comparison and find the actual policy conclusions. Wizarat (1981) and khan (1994) find out the agriculture productivity index by using the crop of subsector. To find out the input index they didn't use any purchase inputs. However, Khan (1997) include fertilizer as an intermediary input. To find out the agriculture output Khan used the value-added index and Rosegerant and Evenson (1993) used gross output index as well as the same technique use by Ali (2004).

The current study is distinct from the earlier studies in different ways, Wizarat (1981) in his study he didn't used overall agriculture sector to the build the output index. Ali (2004) in his estimation he didn't use fodder, and wheat straw to build the input index, he concentrates on the inputs for livestock to construct the input index. For the output index he used 13 percent of minor crop. In the present study took all these issues and used agriculture growth, include all missing inputs. which contain major crops, minor crops, and livestock etc. and during the precious studies the poultry meat was not included to find out the overall agriculture productivity.

Ali (2000) tackled the long run issues of irrigation. Which decrease the agriculture productivity of Pakistan? But in his study, he took the statistics of just 16 watered districts of Punjab. He finds out separately the total factor productivity of agro ecological zones. But in the present study to investigate the TFP of agriculture sector, the data has been taken on the national level. In the current study we take the data of overall arable land of Pakistan not only the data of some districts, or some provinces. Sabir and Ahmed (2003) calculate the TFP of different agriculture sector and his study is restricted just to the fundamental change reforms. Ahmed and Bukhari (2007) assessed total factor productivity of agriculture sector as well as by sector wise. To influence the TFP of agriculture sector he concluded different factors human capital, agriculture value added, cotton production and development expenditure. The current analysis emphasis to recognize that how the TFP of cultivation sector effected on the economic development.

The current study the statistics has been employed from 1980 to 2018. The main role of the current analysis is to get out the effect of TFP of agriculture region on the GDP development of Pakistan. In the present study we used the variable as whole, for example the variable use in the current study is arable land and agriculture growth etc. Arable land used in the current study is the overall arable land of the country not only some districts, and the same method were used for the other independent variable. The other major contribution of the current study is to calculate the long run association amongst the variables. It tells about the direction of TFP growth and it gives the policy implications, how to get sustainable agriculture growth. And if there is a sustainable agriculture growth then we can achieve the sustainable economic growth.

The inputs like land, labor, and capital is used in the agriculture output don't show any efficiency, when calculating agriculture productivity. It is done when calculating TFP of agriculture sector. The estimation of TFP of agriculture sector has been done and mentioned in the literature. The result of these studies shows that there is a variance between the studies, it is because of different indexing methods. The results of different period show that there is a flaw in the output and input.

3.8 Total Factor productivity of Agriculture Sector

The agriculture and the TFP growth rate of Pakistan has been calculated using ARDL approach. Table 3.1 indicates the agriculture outputs and TFP growth of Pakistan from 1980 to 2018. And the figure 3.1 clarifies the graphical presentation of agriculture and TFP growth of Pakistan.

Table 3.1

Agriculture Output Growth and Agriculture TFP Growth

years	Agriculture GDP Growth	Capital Growth	Labor Force Growth	Agriculture TFP
1961	3.15	-0.27	2.26	1.99
1962	0.56	0.52	2.46	-1.06
1963	5.84	-1.83	2.58	5.18
1964	6.53	-2.01	0.48	7.13
1965	6.25	0.40	7.37	1.91
1966	-3.09	-3.25	4.73	-4.36
1967	10.31	-4.83	-3.49	14.38

1968	10.54	-5.34	3.23	11.03
1969	-0.97	-0.86	10.96	-6.80
1970	10.97	-3.76	3.51	10.60
1971	-3.73	-3.49	14.28	-10.30
1972	2.91	3.29	6.31	-2.09
1973	6.02	2.24	4.57	2.45
1974	-0.21	-0.07	11.70	-6.80
1975	-1.84	-1.75	9.19	-6.29
1976	3.98	3.45	10.24	-3.31
1977	4.97	3.04	7.49	-0.59
1978	5.72	3.42	7.89	-0.24
1979	-0.14	-0.39	12.32	-6.95
1980	7.03	2.23	8.36	1.33
1981	12.52	1.71	10.61	5.77
1982	9.09	5.45	15.41	-2.01
1983	2.37	1.87	9.90	-4.05
1984	-3.03	-3.40	5.70	-4.79
1985	9.93	9.22	2.96	4.25
1986	2.12	2.18	1.94	0.08
1987	1.17	1.40	11.56	-5.98
1988	6.67	7.09	-4.52	6.16
1989	8.70	6.86	10.05	0.04
1990	0.73	0.65	3.67	-1.63
1991	3.77	3.97	2.41	0.68
1992	9.93	2.49	6.58	5.13
1993	-3.60	-3.50	5.77	-5.36
1994	5.90	6.37	0.30	2.97
1995	8.30	5.30	11.22	-0.35
1996	2.22	2.26	-3.76	3.37
1997	5.85	3.42	2.86	2.74
1998	4.88	4.33	4.71	0.34
1999	2.60	2.28	9.33	-3.67
2000	0.01	-0.67	5.04	-2.56
2001	-5.23	-5.24	7.46	-7.19

2002	0.05	0.85	-0.47	-0.05
2003	4.89	5.98	-2.91	3.94
2004	1.95	2.75	6.41	-2.88
2005	4.18	5.34	7.66	-2.47
2006	13.82	3.90	7.02	8.15
2007	5.06	6.01	8.33	-2.26
2008	1.92	2.56	3.74	-1.30
2009	6.39	7.03	5.46	0.25
2010	3.22	3.56	3.99	-0.58
2011	10.07	3.98	5.10	5.45
2012	-2.34	-2.14	0.47	-1.68
2013	5.54	6.09	1.39	2.11
2014	5.56	5.87	3.38	1.10
2015	6.51	6.64	0.96	3.09
2016	-0.32	-0.32	7.09	-4.20
2017	-1.18	-1.00	2.96	-2.43
2018	-1.13	-0.87	0.58	-1.09

Source: Author own findings

Figure 3.1 confirms the productivity of inputs, outputs and the TFP of farming sector of the country from1960 to 2018. The results of the calculation show that there is in stability in the agriculture growth rates. And the agriculture total factor productivity growth rates show some consistency.

Agriculture GDP and Agriculture TFP (1980-2018)
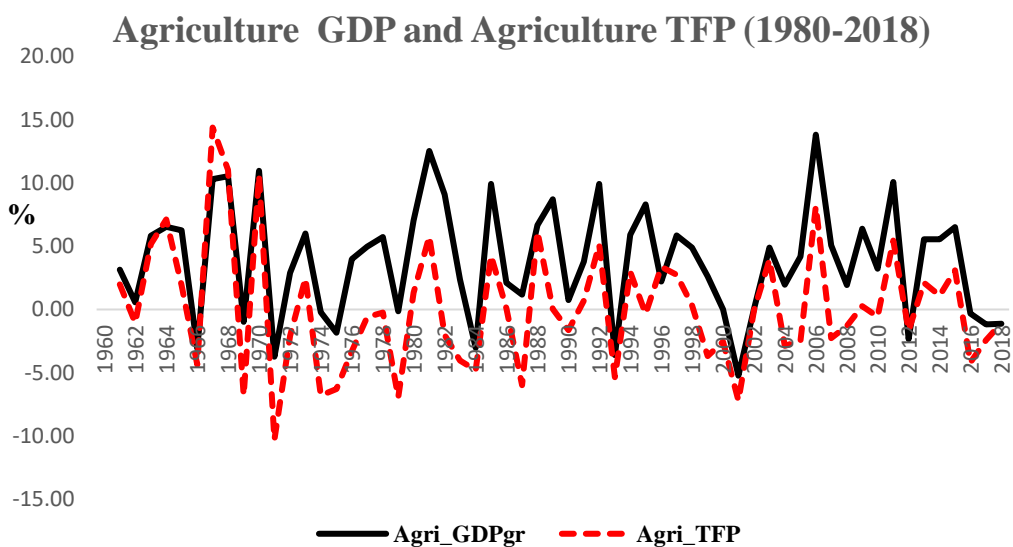
Figure3.1: Trends in Agriculture and TFP Growth

Source: Graph constructed from auther own data

Table 3.1 indicates that the total factor productivity of agriculture sector is growing at the rate of 0.17 percent from (1980-2018). By viewing the result the data shows varience in the data. So, according to the result the the total factor produtivity has a considerable influence on the agriculture development, performence from the last 38 years. The result shows that TFP of agriculture sector contributed almost half to the agricultre productivity of pakistan. Wizarat (1981) estimated the TFP of agricultre sector of pakistan. And the increase in TFP expansion ratio was 1.1 percent, which remains more than current study, it is may be the difference between the time period i.e 1953-79. This is the era of green revoluation and public investment made in the period of 1970.

Figure 3.2: Adjustment of the Capital Stock

Table 3.2 indicate the adjustment of capital stock over output. The value of R square is 0.6778 and the value of capital over GDP is 1.7757. The graph analyzes the reducing trend in the capital stock over time.

DATA SOURCES:

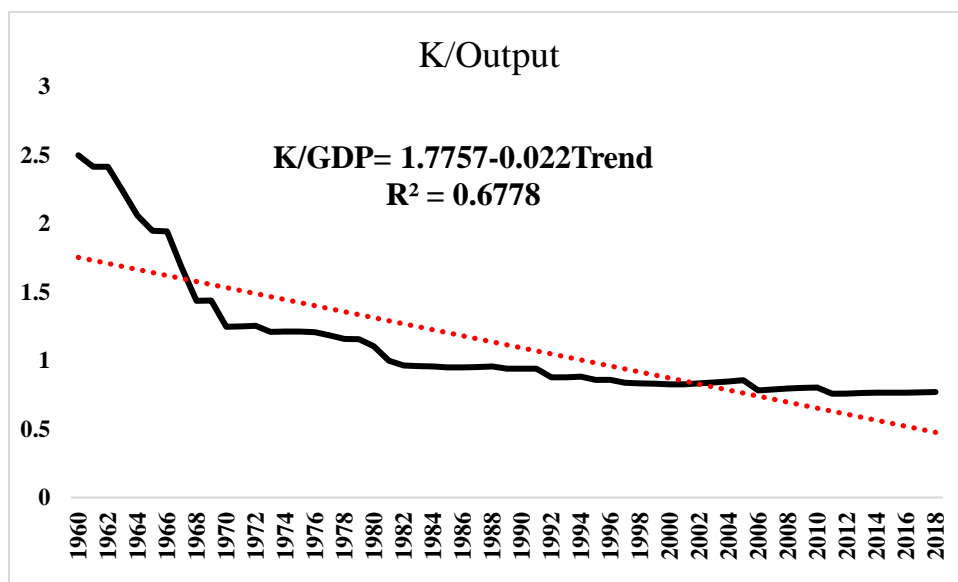To estimate the TFP of agriculture sector, time series data of capital use in agriculture and capital use in agriculture are needed. The study is estimated from 1980-2018. The data of capital stock is not accessible in the national income accounts. Therefore, so it has been calculated since fixed capital formation. The data about labor force in agriculture sector, for 1981-2018 was held from 50 Years of Pakistan in Statistics, Volume I, summary. FBS. Statistic Division, Government of Pakistan (GOP), Islamabad. The data about capital were held from Statistical Yearbook 2006, FBS, Statistics Division, GOP Islamabad.

3.8 Descriptive Statistics of the Variables

This section provides the empirical results in addition to the long run association within the variables. Prior to the examination of long run and short run aspects, different tests have being applied in this section. Augmented Dickey Fuller approach is employed to determine the order of integration, and to find out the existence of covariance among the variable. Auto Regressive Distributed Lag (ARDL) technique is utilized to test the cointegration and using Error Correction Mechanism, for the short run aspects of the variables. At the end of the estimation the to get for sure that the model is stable or not, for the stability of model Cusum test is performed and to examine the strength among the variable the correlation test is used.

It is very necessary to understand the characteristics of the data; and the summary statistics of the variables is the process of the data. It is important in that way if the information is confirmed in a sample way, rather than if the information is confusable. So, the descriptive statistics tell about the data or information in advance. If the data of a research is large, then it presents this in a summary form. Descriptive statistics of the variable are as follows.

The below table indicates the summary statistics of all variables.

Table: 3.2

Summary Statistics of the Variables

	GDP	CS	LF	AG	AL	FPG
Mean	4.921722	3.923673	46.65495	3.550562	39.70058	39.70058
Median	4.846581	4.327710	46.79000	3.497601	39.48734	39.48734
Maximum	10.21570	19.90113	54.01000	11.72315	42.98983	42.98983

Minimum	1.014396	-7.705547	41.01000	-5.286028	38.12526	38.12526
Std. Dev.	2.075618	6.253514	4.056308	3.495969	1.027062	1.027062
Skewness	0.171663	0.179011	0.264294	-0.188650	0.997450	0.997450
Kurtosis	2.732285	2.958724	1.673439	3.946157	4.245383	4.245383
Jarque-Bera	0.308008	0.211060	3.313653	1.686050	1548.323	251.5007
Probability	0.857268	0.899848	0.190743	0.430407	0.011180	0.000000

Source: Writer personal findings

Table 3.2 explain the summary statistics of all variables. Throughout the research the time series data of components have utilized from 1980-2018 in which consist of 39 observations. The table indicates that the average value of GDP is 4.92 with the standard deviation of 2.08. The average value of capital stock is 3.92 with 6.25 standard deviation. The mean value of labor force is 46.65 with the standard deviation of 4.05. The mean value of agriculture growing is 3.55 with the standard deviation of 3.49. The mean value of agriculture land is 39.70 with the standard deviation of 1.02. And the average log value of factor productivity growth is 39.70 with the standard deviation of 1.02.

Jarque-Bera technique is utilized to check out the goodness of fit and it informs about the residuals, whether it is normally distributed or not. In the current analysis the variables are GDP growth, capital stock, labor force, arable land, agriculture growth and TFP growth. All the variables remain normally distributed, and the probability of the variable's estimation shows the Jarque-Bera probability.

3.9 Summary

This chapter was distributed into three sections. Section one explains the data source. For any successful economic analysis there is need of proper data. This is very difficult task to collect the data of output and input groups of crops. As well the data of macro variable are also difficult to collect. Therefore, to investigate the impression of TFP of farming sector on economic progress, then out country is still lacking to provide the accurate data. The of land, labor, capital (including tractors, tube wells and working animals, arable land have being taken for the period of 1980 to 2018 for the construction of model. The procedure of capital stock was also explained in this chapter.

The current chapter also shows the result of TFP of agriculture sector of Pakistan during 1980-2018. The result shows that, the average agriculture region TFP rate of the country is 0.17. The study explained that TFP holds a significant effect on the agriculture expansion performance of the country. The highest TFP was 2.86 percent during 2000-06 and the lowest TFP was 0.96 percent in 1972-78. The TFP of agriculture sector shows a positive trend during 80s and 90s. The study covers also those factors by which this study is different.

Section two explain different approaches by which the total factor productivity is measured. This section also explains the importance and the reason of using parametric and non-parametric approach. Section three explain the data descriptive of the variables. As well as, this chapter also analyze the result of the agriculture TFP from 1980-2018. Table 3.1 shows the TFP of farming region of Pakistan. The result shows that, the average agricultural region TFP rate of the country is 0.17. The study explained that TFP has a significant impression on the agriculture growth performance of Pakistan. section two also illustrate that finding of previous studies and the current study, the study also analyzes that how this study is different from the other studies.

THEORETICAL AND METHODOLOGY FRAMEWORK

4.1 Introduction

The study has been organized to find out the change of factor productivity growth of farming sector and the economic growth of the country. In order to explore the correlation among the variables and agriculture productivity, firstly the agriculture sector productivity has been estimated. So, the study conducts the analysis in two stages. First stage estimates the methodology framework of growth that how the growth was calculated in the agriculture sector. The second stage explains the methodology framework, evaluate the effect of TFP of agriculture region on the country economic growth from 1981 to 2018. This section also discusses the similar methodology concepts and model condition that are applied for empirical analysis in the that study.

4.2 First stage Analysis: Determination of Total Factor Productivity of Agriculture Sector

Different method is used to estimate the agriculture sector productivity growth, but they are bound to yield different outcomes. So, to estimate the agriculture sector productivity growth, study extends the Solow Swan (1956) growth model. In general structure the Solow growth model depends on factor of productions. Two models have been constructed in this study. The models are as follows.

4.2.1 Model 1

$$Y_t = A_t f(K_t, L_t) \tag{4.1}$$

Where   K = Capital of Agriculture sector

L = Labor Force in Agriculture sector

A = Solow Residual / Total Factor Productivity Parameter

The accuracy of the estimation result depends upon clearly on the input and output of the data, which is every so often poor. Even when the data is perfect, so the Solow residual do not find necessarily produce unbiased results. The reason behind is that the agriculture productivity growth is low due to environmental losses. These costs should not count in the value of output and the elimination of this operation would be the reason of residual, to overestimate productivity growth.

Solow further explain the production function through the Cob-Douglas production function:

$$Y_t = A_t K_t^\theta L_t^{1-\theta} \tag{4.2}$$

Taking the log of equation 2:

$$\ln Y_t = \ln A_t + \theta \ln K_t + (1 - \theta) \ln L_t \tag{4.3}$$

Where $\theta, 1 - \theta$ explain the portion of capital and labor in output growth of the agriculture sector. Differentiate the equation 3 with respect to time:

$$\frac{\frac{dY_t}{dt}}{Y_t} = \frac{\frac{dA_t}{dt}}{A_t} + \theta \frac{\frac{dK_t}{dt}}{K_t} + (1 - \theta) \frac{\frac{dL_t}{dt}}{L_t} \tag{4.4}$$

The equation 4 explained output decomposed into total factor productivity (TFP) growth, weighted sum of capital and labor growth. Solve the above equation for TFP growth

$$\frac{\frac{dA_t}{dt}}{A_t} = \frac{\frac{dY_t}{dt}}{Y_t} - \theta \frac{\frac{dK_t}{dt}}{K_t} - (1 - \theta) \frac{\frac{dL_t}{dt}}{L_t} \tag{4.5}$$

$$TFP growth = Y_{growth} - \theta K_{growth} - (1 - \theta) L_{growth} \tag{4.6}$$

TFP growth is the weighted sum of capital and labor growth subtracting from output growth. For the calculation of the agriculture TFP, data of labor and output available in various published sources. While study used the perpetual inventory approach to determine the capital stock series data.

General structure of capital stock equation:

$$K_t = I_t + (1 - \delta) K_{t-1} \tag{4.7}$$

δ is the depreciation rate and Nehru and Dhar Eshwar (1993) the calculated capital stock series is given below

$$K_t = \sum_{i=0}^{t-1} (1 - \delta)^i I_{t-i} + (1 - \delta) K_0 \tag{4.8}$$

Primary capital stock is denoted by K (0) and with the time is shown by 0. Nehru and Dhar Eshwar (1993); Collins and Bosworth (1997) estimated capital stock series by using, with the rate of depreciation is constant, and that rate was 4 percent annually. But it is notice that depreciation rate

is increasing and decreasing with the time. To resolve the problem, utilize the following adjustment formula:

$$K_{t-1} = \frac{I_t}{g+\delta}$$ (4.9)

Solved this formula for the δ (depreciation rate):

$$\delta = \frac{I_t}{K_{t-1}} - g$$ (4.10)

From the equation 10 we can calculate the time varying depreciation rate.

Due to output data for environmental losses i.e. Total Sustainable Factor Productivity (TSFP). Unfortunately, the measurement of environmental losses is very difficult and there is no other or universally known proxy for it. The benchmark year can be avoided by estimating the chained index or the overall production of the year. So, in this case it is possible to drip the assumption of fixed shares, by using trans log production or corresponding Divisia index. None of these measure through traditional method can distinguish between the pure technical progress. As well as the efficiency of the production will as also decrease if the proper method of measurement is not used. This difference is possible by using different method of measurement, the Malmquist index, it does assume that the optimizing behavior by agents shift from the conventional production function framework (Fare et.al, 1998, Ruttan 2002, Nin er.al, 2003).

4.3 Second Stage Analysis: TFP of Farming Sector and GDP Growth of Pakistan

In the present section we discuss, the TFP of agriculture region and GDP growth of Pakistan. The data took from Economic Survey of Pakistan from 1980 to 2018. It provides information about the variable use in the study, as well as the current situation of the economy. The current study gives the realistic overview of the TFP and the GDP growth of the country. The methodology section contains the model by which the estimation is determined.

In the present study the determined variable are GDP growth and the impartial variables are capital stock, labor, arable land and agriculture growth. The design of model is as follow

4.3.1 Model 2

GDP growth= f (capital stock, labor force, arable land, agriculture growth, TFP)

Econometric form of the model is

$$GDP = \alpha_\circ + \alpha_1 CS + \alpha_2 LF + \alpha_3 AL + \alpha_4 AG + \alpha_5 TFP + \epsilon_{t\dots} \qquad\qquad 4.11$$

Where

GDP = Economic Growth

CS= Capital Stock

LF= Labor Force

AL= Arable Land

AG= Agriculture Growth

TFP= Total Factor Productivity

α is a constant and ϵ_t is a constant error term.

4.3.2 Variables

The independent variable used in the study and their impact on the dependent variable are as follows.

Capital is the core for the economic development. Capital is considered one of the major components of production. It plays a crucial role in the modern production system, because with the help of capital we can increase production and productivity. We cannot suppose production without a capital. We cannot utilize land and labor without capital because they cannot produce anything without the usage of machines, tools and equipment. The role of capital is more important and significant, with the technological advancement and specialization because these things can increase the production.

Capital is the major component for the increasing productivity. For example, former works in their form with the help of animals, animals can use for cultivation, so they consume much time. But after the introduction of machinery like tractors etc., use in the agriculture sector they are less time consuming and the productivity can also higher than the animals use for the cultivated. With the help of tractor former can plough many acres of land in a day. But it is difficult with help of animals. If a country like Pakistan wants to become rich so their must use machines and

technologies in the agriculture sector. In the developed countries like Japan, USA and UK they can use modern machinery and tools for cultivation so in a result they can yield higher production as compare to Pakistan. with the help of capital, the worker can improve their efficiency so in the result the will production of goods will increase.

Labor is also one of the important factors of the agriculture output. But in Pakistan labor in agriculture sector is decrease day by day. The reason behind is that the agriculture region jobs remain seasonal, then the worker of the agriculture sector retains work for few months, so in a result they are searching for a permanent job. The wages in the agriculture sector are very low as compare sector of industrial and services sector, so that is why people can migrate from the rural sector towards the urban sector for better education and job. In the agriculture one of labor shortage reason is, the labor can migrate to foreign countries because the wage rate is high. Pakistan is agriculture-based country, so there is a need to provide the facilities to the people of rural sector to overcome the shortage of labor force in the farming sector. If there is the existence of skilled labor available in the agriculture sector, so then we can improve the productivity of the agriculture sector. And in that's way we will be able to enhance the economic growth of the country.

Arable land is also crucial to want increase in the production of agriculture sector. Adelman (1979); and Rodrik (1994) described that south Asian countries like Pakistan can be placed in the group which have not undertaken land reforms so in a result there is a lower economic development as compare to countries Japan, Korea and Taiwan which have undertaken land reforms. In Pakistan (% of land area) was 39.54 as of 2018, and during 1982 it was 42.99, it is the highest value noted from the past 54 years. While the lowest value noted was 38.10 noted in 2010. If a country needs to increase the economic growth, so there is need to increase the arable land when the arable land is increase so the production will increase.

Agriculture growth is also the vital factor of the economic growth. Pakistan is agriculture-based country and without that sector the sustainable economic growth is not possible. Agriculture growth is necessary if country like Pakistan want to achieve the economic growth. Because it shares to GDP is 18.9 percent and 42.3 percent to total labor force (ESP).

TFP is also one of the essential factors of the economic growth. The results describe that the TFP has an encouraging and substantial effect on the economic growth, as well as by the capital stock and labor of the country. And the impact of TFP on the economic growth is more than in the

developed countries if equate to the developing countries, it is because of the lower TFP rate in the developing countries and higher TFP rate in developed countries. It is considering the primary contributor to the GDP growth. And the other factor, which is included labor, capital. TFP calculated the residual growth of the firm in the total output, or in the national wealth. It can't be described through the growth of inputs, labor force and capital stock.

4.3.3 Methodology

To evaluate the time series data different error modification approaches are used on the way to investigate the effect of TFP of agriculture sector and GDP growth of the country. To obtain out the long run and short effect, ARDL model has been utilized. It is important to analyze stationarity of the time series data. So, unit root technique is applied to confirm stationarity in the time series. The investigator use classical regression study, when the data is in time series form, so the classical regression study assume that time series data are non-stationary and on the basis of this theory the t-test, F test and x^2-tests. If the time series data in non-stationary, then the general statistical approach have not been recommended. It is very valuable for the reason that at the time of regression the most of the time series data change with the passage of time, might be bogus in nature, or it might generate the significant result but with the high R2 so it is not a reasonable implications (Granger and Newbold, 1974). To estimate time series data, first stage is testing the unit root. To check the unit root hypothesis different method are used but the most common is Augmented Dickey Fuller (ADF) analysis by (Dickey and Fuller, 1979,1981). In the time series econometric literature, the ADF is commonly used.

Pesaran and shin (1999) confirmed that the ARDL model denoted the single co integration. And the benefit of the ARDL model remains that, it doesn't need all variable to be I (1) as in the Johanson framework. If the variable has I (0) and I (1) so it will be suitable for the estimation. There is different characteristic of the ARDL techniques, which are as follows.

- ARDL method is dissimilar from the other methods, it is the mixture of integration in a different order, in integration it conclude that it is suitable and irrespective of different orders, whether the integrated value is 1 or 0.
- In this model for different variables Diverse Lag Length are used.

- It is appropriate to compare with short model methods as well as relate to the other techniques.
- It is very easy as well as simple, to recognize in a specific equation, as well as it is simple to explain plus solvable.
- The main component is Error Correction Model (ECM), and its finds out from ARDL with the simple linear conversion.
- Nkoro E & Uko, A. K. (2016) describe that its figure out short run as well as long run coefficient collectively.

4.3.4 Assumption of the ARDL Technique

Nkoro & U ko, A.K. (2016) explain the theory of ARDL methodology

- In ARDL if a variable is not incorporated in order so it cannot be estimated. For example, 1(2) in this situation the F stats value, the test will be invalid.
- In ARDL the number of lags must be suitable.
- It is necessary that the error must be in order independent.
- The model will be stable dynamically.
- Once the variable is stationary at level so we can utilize the ARDL. And if the variable is level at the first difference, we can apply ARDL.
- And when the variables are stationary at level, and stationary at first difference, then we can applied ARDL.

4.3.5 Benefits of ARDL Technique

Benefits of the ARDL technique are as follows

- ARDL is very beneficial if the sample size is small.
- With the support of Error Correction Term, we find out the speed of adjustments.
- It tells us the short-term relationship as well as the long relationship.
- Duasa (2007) describe that it is possible with the ARDL approach that different variable has different lags, and it is difficult with the cointegration test.

- Narayan 2004 describe that the more important is that the model will be utilized with partial sample data of 30 to 80 observations, so the set of critical value have been created formerly.

4.3.6 Procedure of Bound Testing

Bound testing methodology is employed to show the long-term correlation amongst the variables. It is used to verify whether the long-term relation exist or else not. This procedure is vital for the application of ARDL approach. On the way to verify the long run association amongst the variables this methodology remains applied. This method is useful if the sample size is small.

Pessran and Pesan (2001) recommend that if there is cointegration between the variables, or if the Wald test estimation in greater than the value of recommended bound by null hypothesis permitted if there is no concern amongst the variables. And if the amount of bound is larger than the F value. And if the estimation value of Wald test lays in lower and upper bound, then the outcome will be undetermined. It is an appealing situation to detect occurrence of cointegration amongst the variables, and the amount of Wald test remains more than the upper bound crucial incentive.

Lag level coefficients of variables have been restricted to nothing or zero then using bound tehnique, to verify the long-run equilibrium association. Null hypothesis of test:

In a growing country like Pakistan, it will confirm that while there is negative or positive impact of TFP of agriculture sector. The growth equation consists on dependent variable GDP whereas capital stock, labor, arable land, agriculture growth and TFP are independent variable of the model. While applying bound test, coefficient of lag level of variable is restricted to zero. It is because of to verify the long run equilibrium consortium. Test of null hypothesis.

$$H_o: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

$$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$$

$$\Delta GDP = \beta_0 + \beta_1 CS_{t-1} + \beta_2 L_{t-1} + \beta_3 AL_{t-1} + \beta_4 AG_{t-1} + \beta_5 TFP_{t-1} \dots + \sum_{i=1}^{p} \delta_{1i} \Delta GDP_{t-1} +$$

$\sum_{i=0}^{p} \delta_{2i} \Delta CS_{t-i} + \sum_{i=0}^{p} \delta_{3i} \Delta L_{t-i} + \sum_{i=0}^{p} \delta_{4i} \Delta AL_{t-i} + \sum_{i=0}^{p} \delta_{5i} \Delta AG_{t-1} + \sum_{i=0}^{p} \delta_{5i} \Delta TFP +$

μ_t \hfill 4.12

Here is a long run association around the present model due to acceptance of Ho, and the value of F test is calculated, which exceeded the quantity of upper bound. The later stage is to determine the long run parameters from equation 4.12.

$$GDP_t = \theta_0 + \theta_1 CS_t + \theta_2 L_t + \theta_3 AL_t + \theta_4 AG_t + \theta_5 TFP_t \hspace{2cm} 4.13$$

Unrestricted (ECM) have being employed, to detect the short run estimation of the model, the equation of the ECM model is given below,

To estimate the model for the finding of short run, the unrestricted ECM have being used, so the equation of ECM is specified below.

$\Delta GDP_t = \gamma_o + \sum_{i=1}^{\rho} \gamma_1 \Delta GDP_{t-1} + \sum_{i=o}^{\rho} \gamma_{2i} \Delta CS_{t-1} + \sum_{i=o}^{\rho} \gamma_{3i} \Delta L_{t-1} + \sum_{i=0}^{\rho} \gamma_{4i} \Delta AL_{t-1} +$

$\sum_{i=1}^{\rho} \gamma_{5i} \Delta AG_{t-1} + \sum_{i=o}^{\rho} \gamma_{6i} \Delta TFP_{t-1} + \Psi ECT_{t-1} + \epsilon_t$ \hfill 4.14

4.3.7 Equation of ECT

Error correction term (ECM) indicates times series model most generally a data in which a primary variable has utilized. For a co integration a long-term stochastic pattern is supposed. To compute the long run along with the short run effect, it is onetime procedure upon another, and it is a hypothetical determined method. It informs about the long run speed of adjustment. It implies that if the dependent variable is far from the equilibrium due to any reason, so it tells us how much time is required to reach at the equilibrium point.

$$ECT_{t-1} = GDP_{t-1} - \theta_o - \theta_1 GFCF_{t-1} - \theta_2 L_{t-1} - \theta_3 AL_{t-1} - \theta_4 AG_{t-1} - \theta_5 TFG_{t-1} \hspace{1cm} 4.15$$

4.3.8 Error Correction Mechanism

When the estimation of long-term relationship has finished, so after that the next phase is to compute the long-term correlation among the variables. So, it is calculated with help of ECM. To calculate the long run and short run connection, it is theoretical determined methodology for one-time procedure on another. It tells us about the long run speed of adjustment. It tells us how much time is require reaching the equilibrium position as well as it tells about the reasons, of why the

dependent variable is far from the stability level. The amount of error correction mechanism remains significance and negative. And the amount of ECM will between 0 and -1.

McKay et al., (1998) describe that the specification of ECM is based on the idea, that in the long run equilibrium relationship the adjustment made to become closer. The link between error correction mechanism and cointegrated series is intuitive, and the relationship of cointegrated stationary has induce by error correction behavior.

4.3.9 Normality Test

Normality test is being used to evaluate the residual are distributed normally or not, and this is necessary for the application of ARDL. Generally, it is supposed that the estimation process is dispersed normally. It is essential for the correct result of f-statistics as well as for t-statistics. Without this the correct result is not possible.

4.3.10 Empirical Model

The empirical model used in current analysis, is focused on the elements of economic growth in Pakistan. The determining factors of economic growth are categorized in capital stock, labor force, arable land and TFP. The following model have being constructed to explore the effect the various variables on the GDP growth of the country.

$$GDP = f(CS + LF + AL + AG + TFP) \qquad\qquad 4.16$$

Where:

GDP= Economic Growth

CS= Capital Stock

LF= Labor Force

AL= Arable Land

AG= Agriculture Growth

TFP= Total Factor Productivity

Economic development is assumed to be a function of capital stock, labor force, arable land, agriculture growth, and TFP, and these variables were supposed to be affecting the economic growth directly or indirectly.

4.4 Summary

Chapter 4 consist on two sections. Section 1 defines that how the TFP will be measured. And the agriculture TFP effect the GDP growth of the country, this chapter also evaluate the dependent and independent variables, which is employed during the study. Section 2 described the theory of ARDL model and ADF to realize the impact of independent variable on the economic growth of Pakistan. ARDL formula is used for productivity measurement. This section also shows the dependent variables and independent variable, which is used to find out the GDP growth, It tells us about the relationship amongst the determined and independent variables. In the current research the estimated period has been use for productivity is from 1980-2018.

RESULT INTERPRETATION AND DISCUSSION_____

5.1 Introduction

The result of TFP of agriculture sector of and economic growth of Pakistan has been described in this chapter for the period of 1980 to 2018. Used the ARDL technique to find out the result of the whole study, as well as explained the TFP with the decade wise. To discuss the result of agriculture TFP growth and its contribution. Augmented dickey fuller test has been utilized to obtain the order of integration, Bound test is used to get whether the co integration is exist or not. Co integration has tested by the Auto Regressive Distributed Lag method. with help of Error Correction Mechanism, the short run factors are estimated. After the estimation the bound test is employed to calculate he stability of the model.

It is necessary to realize that which technique is used in the research, ARDL, OLS or Co integration. Augmented Dickey Fuller (ADF) is utilized to determine the order of integration. And if the variables are stationary at the second difference then we can't utilize the ARDL.

5.2 Augmented Dickey Fuller Test

The alternative as well as the null hypothesis of the ADF approach is given below

H0: if the data is not stationary then a variable holds a unit root.

H1: if the data is stationary then a variable holds no unit root.

The series is stationary when the ADF statistics stays lesser than (right to left) the critical value. Reject the null hypothesis of the unit root by one by the alternative side.

Individual series and for sort of integration, the ARDL technique have been utilized, then the result of ADF is shown by table 5.3

Table 5.3

Augmented Dickey Fuller Test Results

	ADF test stats	-3.913318	
	1% level	-3.615588	Prob
GDP	5% level	-2.941145	0.0046
	10% level	-2.609066	
	ADF test stat	-4.547893	Prob
CS	1% level	-3.615588	0.0008
	5% level	-2.941145	
	10% level	-2.609066	
	ADF test stat	-1.575075	Prob
LF	1% level	-3.615588	0.4853
	5% level	-2.941145	
	10% level	-2.609066	
	ADF test stat	-3.510932	Prob
AL	1% level	-3.615588	0.0130
	5% level	-2.941145	
	10% level	-2.609066	
	ADF test stat		Prob
AG	1% level	-4.029097	0.0046
	5% level	-3.699871	
	10% level	-2.976263	
		-2.627420	
	ADF test stat	-5.872079	Prob
FPG	1% level	-3.626784	0.000
	5% level	-2.945842	

10% level	-2.611531

Source: Writer own findings

The result of ADF test is shown in table 5.3

Conclusions of ADF test, for the dependent the same as for the independent variable are GDP, CS, LF, AL, agriculture growth (AG) and factor productivity growth (FPG).

The outcome of the ADF technique shows that the variable GDP has a unit root and a variable is stationary at level. Capital stock is also stationary at level. Labor force is stationary at level and the amount of probability is 0.48 it is higher than 0.050. The next variable is arable land it is stationary at level. Agriculture growth holds a unit root at level however after getting 1st difference it's become stationary. The variable factor productivity growth is at stationary at level and his value of probability is smaller than 0.05.

Co integration approach is used once a few variables is stationary at level plus a few variables remain on level at first difference. The important inspiration behind this analysis is that to check the impact of TFP of agriculture sector and as well as the economic growth of Pakistan. in this research two models have been utilized. Model one tells that how to find the TFP of the agriculture region of the state. And model two investigate the impact of capital stock, labor force, arable land, agriculture growth and the TFP on the GDP growth of the country.

In the current analysis we employed ARDL technique, for short run ECM is used and to realize the result very well we applied Cusum test.

5.3 Model 2

Model 2 plays an important role in the present study. The model explains the impact of TFP of agriculture sector on the GDP growth of the countryside. According to results here is a considerable effect of TFP on the economic development of the country. As well as agriculture growth, arable land, capital stock and labor force has also a main source for the GDP growth. It has also the significant effect on the economic progress of the nation. Pakistan remains an agriculture-based country so arable land and agriculture growth is the key for the GDP growth.

In model 2 GDP growth is the dependent variable and the independent variables of the analysis are capital stock, labor force, agriculture growth and arable land of the analysis.

Applying the lag length criteria, optimal lag length of the model 2 is defined. After that ARDL is applied.

Table 5.4

Optimal Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-638.2453	NA	3.65e+09	39.04517	39.31726	39.13672
1	-569.9037	107.6898*	5.35e+08	37.08507	38.98972*	37.72593
2	-530.8950	47.28331	5.61e+08	36.90272	40.43992	38.09288
3	-476.6421	46.03271	3.72e+08	35.79649	40.96625	37.53596
4	-386.9672	43.47876	89639167*	32.54347*	39.34577	34.83223*

Source: Author Own Calculation

Table 5.4 shows the lag length criteria of model 2. There is LR test statistics (LOGLR), Final prediction error, the criteria which is used mostly SC and AIC. With AIC criteria there is 4 optimal lags and with SC criteria there is 1 optimal lag. Akaike information criteria (AIC), schwarz information criteria (SC), and Hannan-Quinn information criteria**.**

Table 5.5

Estimation of ARDL Model

Variable	Coefficient	t-Statistic	Prob.*
GDP (-1)	0.356507	1.217749	0.3104
K	-0.003858	-0.052578	0.9614
K (-1)	0.211060	3.193373	0.0496
K (-2)	-0.013963	-0.255480	0.8149
K (-3)	0.031729	0.566483	0.6107
K (-4)	-0.166074	-3.437116	0.0413
L	0.427311	1.509311	0.2284
L (-1)	-0.199354	-0.574598	0.6058
L (-2)	-0.205556	-0.784171	0.4902
L (-3)	-0.148175	-0.845033	0.4602
L (-4)	0.362932	2.088519	0.1280
AL	-0.020779	-0.024907	0.9817
AL (-1)	-2.734549	-3.707160	0.0341
AL (-2)	-0.085077	-0.172309	0.8742

AL (-3)	1.690307	4.406918	0.0217
AL (-4)	1.046029	2.303354	0.1047
AG	0.460456	4.872079	0.0165
AG (-1)	-0.190497	-2.281198	0.1068
AG (-2)	0.072419	0.880517	0.4434
AG (-3)	-0.059500	-0.386270	0.7251
AG (-4)	0.074252	0.640067	0.5677
FPG	3.73E-05	0.086723	0.9364
FPG (-1)	-0.000442	-0.831140	0.4669
FPG (-2)	0.000285	0.754080	0.5056
FPG (-3)	-0.000548	-1.891574	0.1549
FPG (-4)	-0.001062	-3.123332	0.0523
R-square	0.987207		
F-stats	7.983171		

Source: Author on calculation

Table 5.5 shows the output of ARDL model. The result shows that there is considerable impact of capital stock upon the economic development of the country. Labor strength holds also a significant on the financial growth of Pakistan. Pakistan remains an agriculture-based country so arable land and agriculture growth both have a positive impression on the economic progress of the country. And the TFP has an insignificant impact on the GDP growth of the country. In a state like Pakistan the GDP growth will be rises by CS in a few ways. There is a need of technology and information spillovers. Due to CS the production will increases, when the production of the industry increases then it increases the foreign exchange earnings. There is a need to invest in those sectors which is less developed. As well as the physical and human capital is also extremely valuable for the economic development of the country (Asghar Ali 2011).

Pakistan has a farming base population so for the economy of Pakistan labor force, arable land and agriculture expansion is extremely essential for the rise in the GDP of the country. There is need to know the importance of these factors. In Pakistan the labor is less skilled, arable land are not proper utilized and the agriculture growth are not as per the requirement. In the current estimation the quantity of R square is 0.98, which indicates that how significantly all the independent variables affect the dependent variable of the model.

It remains valuable to know the long run connection amongst the variables, ARDL bound test has been applied before moving towards the outcomes of the short and long run.

Table 5.6

Bound Test

Order of Lag	F-Statistics	Lower Bound	Upper Bound
04	6.625878	2.26	3.35
Significant at	10%		

Source: Author own calculation

With the Bound test, it is confirmed that whether there is a long-term connection or not. The null hypothesis of the analysis shows that here is not any long run affiliation, compared to alternative hypothesis there is a co integration. The rate of F-test is 6.625, it is greater than the value of upper bound 3.35, which is taken from Pesaran (2001) table. There is a co integration if the computed amount of bound test is more than the value of upper bound. If there is the existing of long run affiliation, then we can go to obtain the long run as well as the short run outcomes.

Table 5.7

Short Run Result of ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.096991	0.300678	-0.322572	0.7493
D (K (-1))	-0.020192	0.047910	-0.421461	0.6765
D (L (-1))	-0.253073	0.169020	-1.497291	0.1451
D (AL (-1))	0.259884	0.384966	0.675083	0.5050
D (AG (-1))	-0.131818	0.060687	-2.172105	0.0382
D (FPG (-1))	-0.000323	0.000278	-1.160291	0.2554
ECM (-1)	-0.207790	0.102168	-2.033797	0.3581

Source: Author own calculation

Table 5.7 indicates the short run result of ARDL model. In this model GDP is a dependent variable and capital stock, labor force, arable land, agriculture growth and TFP are the independent variables. When there is an increase in the capital then in a result the gross domestic product will increase. Labor force has also the same impact as gross fixed capital formation. Pakistan is an agriculture-based country, so the arable land and agriculture growth has also the encouraging impact on the GDP. When the arable land and the agriculture growth increases then the productivity will increase then the gross domestic product will increase. TFP has also a substance impression on the economic development of the country.

ECM describes the speed of adjustment; it explains how much time is required to achieve the equilibrium. The tables show that the amount of ECM is negative, and its significance is necessary. The value of the coefficient has a negative sign, it shows that the convergence in the long run. Table 5.7 confirms that the ECM rate is 0.20, it suggests that, if the control variable moving in the consistent path, then every year 20 percent equilibrium is corrected

Table 5.8

Long Run Result of ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
K	0.024737	0.048256	0.512631	0.6436
L	0.099613	0.042449	2.346635	0.1006
AL	-0.043712	0.219460	-0.199179	0.8549
AG	0.150005	0.112598	1.332216	0.2749
FPG	-0.000726	0.000356	-2.038243	0.1343
C	0.893719	7.377801	0.121136	0.9112

Source: Author own calculation.

Table 5.8 proves the long run result of the model. It indicates that here is a substantial effect of capital stock on the GDP growth of the country. It describes, if there is one percent rise in the capital stock, then in the result there is 0.024 percent rise in the economic growth. If the there is one percent rise the labor force, then in the result there is 0.09 percent rise in the GDP discussed by Azam Amjad Chaudhry (2011).

There is depressing and unimportant impression of arable land on the economic development of the country. The outcome confirms that if there is a one percent rise in the arable land then in a result there is 0.04 decrease in the economic growth. There is a positive and considerable influence of agriculture growth on the economic growth of the country. Concerning a country like Pakistan if there is the increase in agriculture productivity. The agriculture growth outcome shows that if there is one percent rise in the agriculture growth then in a result there is 0.15 rise in the GDP or in economic growth Ruttan and Hayami (1985). And if there is one percent increase in the TFP of agriculture sector then in a result there is 0.0007 percent fall in the GDP.

5.4 Serial Correlation LM Test

LM test is employed the determine the sequential correlation in the model.

5.5 Histogram-Normality Test

Brown (1975) created cumulative sum of recursive Residual (CUSUM) and cumulative sum of residual square (CUSUMSQ) to check the steadiness of the parameter and or whether the model is stable or not. When the parameters are constant then its stay amongst the double critical bound, it is symbolized by the speckled line. And the parameter is not stable then the track didn't lie between the two dotted lines.
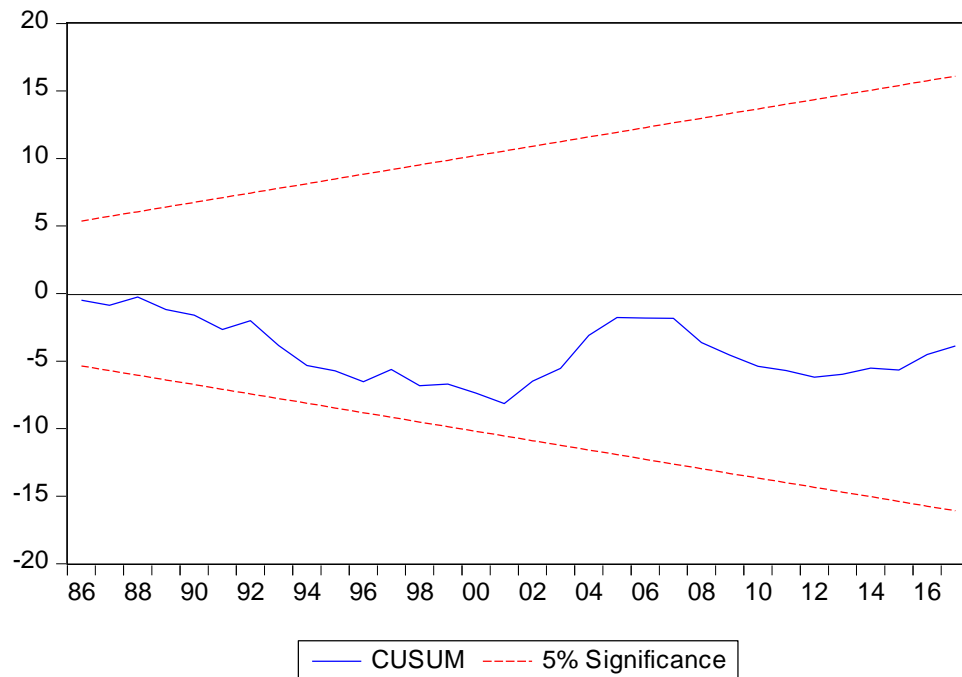

Figure 5.1: CUSUM

The above graph shows the parametric stability test result for the period of 1980 to 2016. It shows that the results are in the critical bound, and there is a consistency in the parameters used for the estimation. The result shows that all the variable lies between the critical bound, and there is a consistency in the variables. In the figure 5.3 the straight shows the critical bound.

The limits are balanced when if they stay down amongst the two critical bound. And if the parameters didn't lie between the two critical bound, then it shows that the limits are unbalanced. So, the result of test proves that parameters lie between the two critical bound, so it shows that the parameters estimated in the study are balanced.
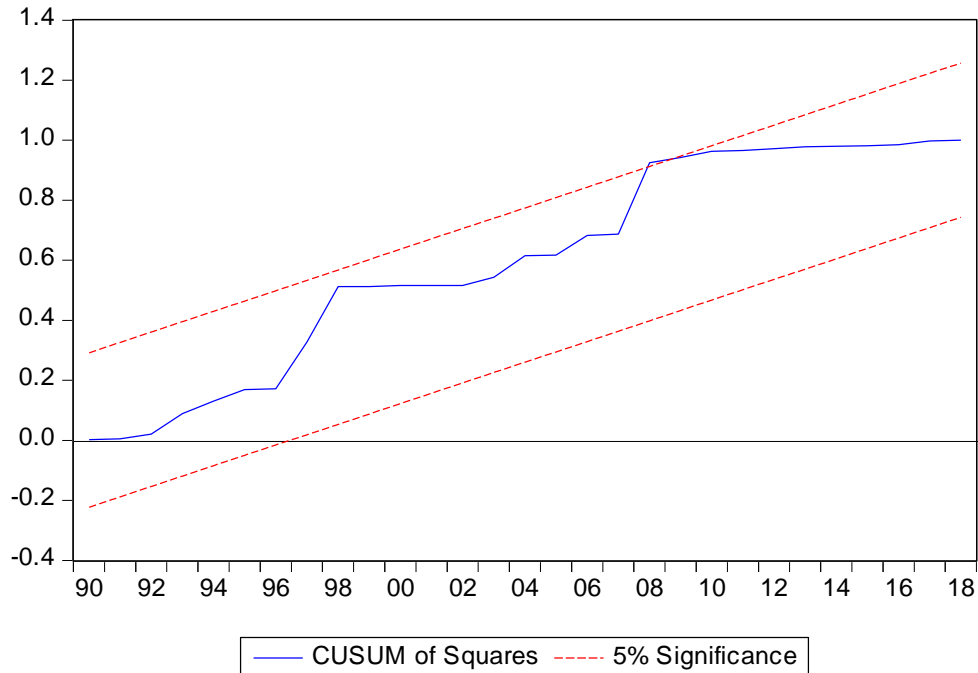
Figure 5.2: CUSUM Sq. Test

5.6 Summary

The current study shows the difference between the current study and the previous study concluded in Pakistan. The study emphasizes on those outcomes which is not the part of previous studies. This chapter also indicates the decade wise growth rate of the variable employed in the research. The analysis also explained the decade wise developing rates of TFP of agriculture region of Pakistan.

In this portion we also get the impact of TFP of agriculture region of the country on the GDP enlargement of Pakistan. Model 1 has been utilized to get out the impact of independent variables (capital stock, labor force, arable land agriculture growth and FPG) on the dependent variable (GDP growth) of Pakistan. ARDL method has been utilized to get out the long run and short run result of the model. For the verification of the long run estimation bound test is used. In both, in the long run and short run the independent variable holds a considerable and encouraging effect on the GDP growth of Pakistan.

SUMMARY, CONCLUSION AND POLICY IMPLICATION_____

In the current analysis first get the TFP of agriculture sector, and then illustrates the effect of TFP of farming sector and the further independent variables on the economic growth of Pakistan from 1980 to 2018. Section 6.1 describe the summary of the study. Section 6.2 describe the conclusion of the study. And section 6.3 gives some policy recommendation according to the result of the study. And in the last section of this chapter, talk about how to improve the study in future.

6.1 Summary

The empirical outcomes of research demonstrate that the TFP varies in the developed and developing countries because the developed countries utilize all the resources very efficiently, their labor force is skilled and efficient they have modern technology and the production growth of the developed countries is also very high if we compare the growth rate of developed to the developing countries. If compare to the agriculture sector of Pakistan with the Brazil, per yield production so many high than the per yield production of Pakistan, the reason is that they attempt the modern way of cultivation rather than the traditional, they use modern technology in their farms. But according the studies examined in Pakistan were Wizarat 1980, Rosegrant 1993, Khan 1994, Ali & Byerelle 2000, pasha et al 2002, Sabir & Ahmed 2003, Ali 2004, Khan 2006, Ahmad & Bukhari 2007, Kiani et al, 2008. Some surveys also identified that there is some economic factor that determine the FPG by changing the quality of inputs. But in the developing countries there is no focus on the theoretical and empirical work on the agricultural sector TFP. There is a question, how the economic development is affected by the increase or decrease in the agriculture FPG. In the current research, it indicates that how the GDP growth is affected, and by whom this growth is effected, this research also shows the variable which is connected with the rise and fall of the economic progress of the country.

The data of five variable is examined in this research which has a significant or insignificant effect on the country growth, agriculture growth is one of them. Results of the estimation of TFP of agriculture sector in 2010-11 was, livestock growth is 3.7 which contributed 11.5 to GDP. From 1990-91 to 2010-11 the share of livestock sector was grown from 30 percent to 55 percent. That is why the role of livestock is very important in the expansion of farming sector at the same time,

it critical for the economic growth of Pakistan. If we compare the livestock growth of Pakistan to other developing countries, so it was very low. So due to the importance of the livestock in agriculture, in the evaluation of TFP expansion the overall sector has being included. The data of all independent variable have been stored from the certified document, the data of fixed capital formation consist on number of tractors, drought animals and tube wells.

The central intention of the research is that to estimate the TFP of agriculture sector and then the impact of capital stock, labor force, arable land, agriculture growth and TFP on the economic development of the country. First, assess the TFP of agriculture sector and second, find the impact of capital stock, labor force, arable land, agriculture growth and TFP on the GDP growth of the country. For estimation ADF Test has been used to examine the unit root of data. To confirm the presence of short run and long run along with the variables bound test is utilized. To achieve the main goal of the study ARDL method is used. Two model has been utilized, first to find total factor productivity and second model is employed to get the effect of the independent variables on the GDP growth of the country.

6.2 Conclusion and Policy Recommendation

TFP is a most important source of development. But in a country like Pakistan the researchers and policy makers didn't give importance to TFP. In Pakistan there is some studies on the TFP of agriculture sector. From 1980-2018 the result of TFP shows that the growing rate of TFP is 0.17 percent annually. It is the lowest possible from the past ten years. The growth rate of TFP was 0.96 percent during 70s. In 80s to 90s the TFP growth was 2.24 to 2.26 percent. The study explains, the TFP growth rate is low as compare to the past.

The result of model 2 illustrate that in the long run there is substantial effect of capital stock on the economic progress of the country. Here is a considerable effect of labor on the economic development. Arable land has an insignificant impression on the economic development of the country. Agriculture growth encouraged economic growth of every country, especially Pakistan because it mainly depends on the production of this sector. The result shows that if there is 1 percent progress in the agriculture growth then there is 0.15 percent expansion in the GDP growth.

The outcomes of the current studies emphasize on the few policy implications. The result of the first model shows the influence of TFP at the GDP growth of the country. The finding confirms

that the TFP growth was more than the physical inputs use in the agriculture growth. In a country like Pakistan there is a lack of water and arable land. So, to reduce poverty and assuring the availability of food, there is a need to develop the agriculture sector of Pakistan. The results also show that labor is the important factor of the agriculture sector of Pakistan. So, there is need to educate our labor to increase the agriculture sector productivity. In a country like Pakistan there is lack of education, or most of our formers are illiterate so due to lack of education and awareness they use the traditional methods in farming, they used old equipment for farming. So, there is need of education and awareness in rural sector of Pakistan. If the formers use the advance tools for cultivation, then the productivity will increase more than the traditional forming.

Capital is also the important factor for the economic growth of the country. There is a need of efficient machinery. For cultivation farmers are using animals rather than modern tools of cultivation. For a country like Pakistan, if we want to increase our agriculture growth, we must use efficient tools of cultivation like tractors, modern seeds etc. So, there is need of investment in the agriculture sector, provide agriculture inputs to the farmers. And if the agriculture inputs are not available or their prices are very high, then in a result production will not as per the requirement.

For the sustainable agriculture growth, the agriculture credit is also very valuable. The people of rural areas or the farmers are poor, they were very weak financially. They cannot afford to purchase modern seeds, tractor, or modern cultivation tools so there is need to provide them the agriculture credit facility, to purchase the require tools as well as provide subsidy to the former. It will enhance the efficiency of agriculture sector, so in a result the agriculture growth will increase.

As per the current study following are the policy implications for the improvement of the TFP of agriculture sector and the economic growth of Pakistan.

1. TFP of agriculture sector indicates that there is a fluctuating trend during 1980-2018. The arable land shows a negative trend, the study explained that there is a need to extend the cultivated area. Because with the time the demand of food is increasing. So, there is need to expand the agriculture inputs to the increase the agriculture growth. The agriculture sector has capacity to response positively. For the sustainable agriculture growth, the role of government is very valuable. There is a need of technology and the favorable economic policies for the agriculture sector of Pakistan. A country like Pakistan there is a lack of agriculture inputs. So, the government should ensure the agriculture inputs to increase the

productivity of agriculture sector. In this way the problem of food will decrease by the increasing the output of the farming sector.

2. To increase the efficiency of labor the education is very important. But in Pakistan the labor is illiterate and unskilled. They did not know how to use the modern technology, there working method are traditional. To increase the efficiency of labor there is a need of education for the labor worked in the agriculture sector. Education has a significant impact on the labor as well as the agriculture growth of Pakistan. For the long run productivity government should pay their role to provide free education arrange training program in the rural sector of Pakistan, as well as government should allocate budget for education and for training. This will help that the people of the rural sector know the importance of education, in the end, it will increase the overall productivity of agriculture sector. There is also a need to provide the free trade facility to the farmers or provide them effective trade policy. In our country, the modern technology is the basic requirement of the farming sector, in Pakistan the worker are not capable to made those equipment's which is used in the farming sector, so the other solution is to import those equipment's, but due to high tax rate the farmers cannot import, so they used the traditional resources like use animals rather than tractors, and sow the seeds by hands which is so much time consuming. Sometime the cultivation period is passed, due to the lack of such inputs the production is not as per the requirement.

3. Capital stock performs a vital job in the agriculture development of Pakistan, there is a lack of capital in the agriculture sector of Pakistan. Due to lack of technology e.g. unpaved roads, there is high transection cost faced by the former as well as there is lack of godowns to store the agriculture products, in the result the agriculture product didn't reached on time to the market. It will cause the loss of agriculture products. The result shows that there is significant impact of capital on the agriculture growth of Pakistan. For a sustainable agriculture growth there is a need investment in the agriculture sector. The government should emphasis on the improving of agriculture infrastructure, which helps the agriculture products will reach to the market on the time. In the result it will increase the exports and foreign exchange earnings as well as it will improve the agriculture growth further. For the sustainable development they should make investment for the improvement of agriculture infrastructure.

4. In Pakistan the people associated with agriculture sector is poor, they will financially very weak. The agriculture credit has a significant impact on the agriculture growth of Pakistan. So, there is need to provide credit facility to the poor former. With the help of this facility the small former increases their productivity, with the help of credit facility they will use modern technology, high yield seed, they can use tractor rather than animals. The government should provide the agriculture credit facility to the small formers, to enhance the agricultural growth. In Pakistan the farmers the illiterate so they didn't know how to get the agriculture credit, as well as he faced the administration problems. So, to eliminate these problems, the government can also provide seeds, fertilizers etc. There is need of filed officer who answerable for the monitoring all the activities of the farmers. He can also motivate the farmers to utilize the resources provided by the government. So, it will improve the agricultural productivity of agriculture sector.

5. In Pakistan the farmers are facing the problem of inflation, and it has a negative effect on the buying power of the formers. Because in our country the prices of those inputs which is used as an input in the farming sectors are very high. So, the poor farmers cannot afford and used the basic inputs for the cultivation of the crop. For example, the prices of the fertilizer are increasing with the time, the prices of electricity is increasing and high yield seeds are very expensive. So, the poor formers cannot afford to buy the basic required things for the cultivation. So, it is the responsibility of the government to provide subsidize fertilizer, electricity, and high yield seeds to the poor farmers. The farmers of the country irrigated the farms by tube wells and by irrigation system provided in the rural sector. But those farmers have faced problem, where the irrigation system is not available, so then they irrigate their farms by tube wells but unfortunately the prices of electricity is very high so the farmers cannot afford such a high price. So, it causes the decrease in TFP of the agriculture products. If we want to produce the agriculture products, so we have to emphasize to reduce the prices of fertilizer, high yields seed and electricity.

6. In a country like Pakistan for the economic growth the agriculture growth is the key. Because Pakistan is agriculture-based country. For the advancement of the country the government should focus on the agriculture sector. agriculture sector provides 43.2 percent to labor force and 18.9 percent to the GDP. It is the key supplier of foreign exchange earnings for Pakistan. The authorities should pay attention to small farmers to promote the

agriculture sector. The population of Pakistan is growing rapidly, so the requirement of food is also rising. So, the current administration should concentrate on the development of the agriculture sector. There is need of biotechnology providing high yield crop, crop diversification, provide the facility of agriculture credit to the small farmers with small interest rates, provide the fertilizer to the small formers on the subsidize rate, and provide cheap electricity for tube wells which is used in the agriculture sector. So, in the result agriculture productivity will increase. In that way the GDP growth of the country will increase.

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